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OBSERVATIONS ON THE STRENGTH OF THE CHIMPANZEE AND ITS IMPLICATIONS

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[*Plate 1*]

Some time after making the tests of the strength of the chimpanzee and orang described in the April issue of THE SCIENTIFIC MONTHLY, 1923, the author endeavored to secure further data, to interpret some of those already gained, and also to ascertain various implications which might open further fields of inquiry.

The dynamometer employed was of 2000 pounds maximum capacity. It is based upon the principle of an elongated metal loop which upon being placed under tension in the direction of its long axis shortens in the direction of its transverse axis, thus moving, in a metal chamber situated in the center of the oval, machinery which turns a pointer. This pointer automatically retains its position at the maximum reading until reset.

The dynamometer was at all times outside of the anthropoid's cage, the animal pulling on a looped rope which was passed through the bars and was attached to one end of the dynamometer, the other end of the latter being fastened firmly to the metal-work in front of the cage by a heavy steel chain. The end of the dynamometer farthest from the rope was fastened to a board on which it lay, the other end being left free in order that the entire stress should come upon the dynamometer itself. The board merely served to prevent the dynamometer from turning over, possibly catching the pointer on some object and thus giving a false reading. This point was carefully watched, but no difficulty was

experienced with the strong smooth pulls which were significant. The dynamometer has been used for testing the back and leg strengths of Muhlenberg College students for anthropometric records and was installed by the Narragansett Machine Company.

In the first of these endeavors only meagre success was attained, since a representative strength test can generally be secured only from an anthropoid of distinctly vicious disposition and then only in a limited interval of time.

The results were not wholly barren, however. Suzette showed none of her former zeal to pull the apparatus apart, and her attitude was such as to warrant the conviction that she remembered it, though the last test had been made many months previously. However, she made a very deliberate two-hand pull, without appearing to exert herself notably. The pull registered 905 pounds on the dial of the recording device. Although less than her previous 1260-pound test, this pull by its very deliberateness and absence of particular effort seemed almost more impressive to the author.

In the case of the good-natured ape Boma there was even stronger indication of recognition of the apparatus; both his previous fear and subsequent curiosity being completely lacking. In fact he acted precisely as he did at the close of the last strength test after he had lost interest in the now familiar apparatus.

Chimpanzee Fanny, who previously refused to have anything to do with the apparatus, was at this later time in her menstrual period, which in some, though not all, apes makes a radical difference in disposition for the time being. Unlike Suzette in whom menstruation makes no obvious difference, Fanny changes from her usual good nature to an extremely violent and vicious mood. No one, not even the keepers, dare trust themselves within her reach at such times; the sight of anyone closely approaching her cage seems to throw her into a veritable frenzy of rage and she grabs at them through the bars with a viciousness which one is tempted to call diabolical, uttering shrill screeches meanwhile. This hostility is not manifested toward her fellow chimpanzees, however.

The author naturally concluded that she would act like Suzette did in the first test, but it turned out very differently. She seized the rope loop, but instead of pulling on it whipped it to and fro violently, screeching at the top of her lungs. She also varied this procedure with furious futile attempts to grab the author and the keeper, who were standing beside the recording device. It was very illustrative of Fanny's trans-

port of rage that she should try to grab persons so far out of her reach. Suzette, though vicious, would not waste her energy in attempts having not the slightest prospect of success.

Plans to secure records at Chicago, Cincinnati, and Pittsburgh proved useless because these zoological gardens had no anthropoid apes of requisite size and disposition. An attempt was scheduled, with very good promise of results, to test the very vicious chimpanzee Mimi of the Philadelphia Zoological Garden, but two days before the date set she developed a limp which persisted until she died several months later, when it was discovered that a compound fracture of the hip bone sustained in some unknown manner had resulted in septicemia and numerous other serious ailments ending in terminal pneumonia, as mentioned in the author's work "Out of the Valley of the Forgotten."

Johanna, a chimpanzee almost as large as Boma (who is the largest chimpanzee at present in captivity), showed a most ludicrous fear of the apparatus. Only on one occasion did she make a pull, but she was at the time in a runway between her indoor and outdoor cages, in which she was cramped for room and moreover assumed so strange and awkward an attitude to pull, not even bracing herself against the framework, that her record of 378 pounds means little except that in so awkward a position the ape could pull more than the average man under the best conditions.

The two small orangs and a 95-pound chimpanzee at this garden were also tested, but did nothing worth recording. They just played with the apparatus.

The author wishes to take this opportunity to express his appreciation of the courtesies and helpfulness of Directors Brown and Hornaday of the Philadelphia and New York zoological gardens and to the keepers and veterinaries of these institutions which rendered feasible the tests, as well as to make grateful acknowledgment to his Alma Maters, Muhlenberg College and Lehigh University, for the loan of apparatus.

The second of the three objectives proved very interesting. Although Suzette's 1260-pound two-hand pull seems to have appeared more impressive to most people than Boma's right hand 847-pound pull, the author judged from the mechanical disadvantages of the position that the latter really was the more significant of the two.

To test this fact he secured the coöperation of a number of students of the college at which he was teaching, Augustana College, at Sioux Falls, South Dakota. Most of these students were members of the

college football team who had been working hard on the farm before coming to college that fall and were therefore well developed muscularly and in good condition.

Two series of tests were made. The first series was made in right-hand pulls in a position as nearly as possible identical with the one in which Boma made his pull and on the same apparatus. The second series was made in two sections, one of quick two-hand pulls and the other of slow two-hand pulls.

TABLE 1

Table of one-hand and two-hand pulls

TEST NUMBER	INDIVIDUAL	WEIGHT OF INDIVIDUAL STRIPPED	FORCE OF RIGHT-HAND PULL	TWO-HAND PULL	
				Speed	Force
		pounds	*pounds*		*pounds*
1	Mr. Fjellstedt	155	180	Fast	395
	Mr. Fjellstedt	155		Slow	368
2	Mr. E. Ormseth	140	No test	Fast	380
	Mr. E. Ormseth	140		Slow	382
3	Mr. Peterson	137	147	Fast	360
	Mr. Peterson	137		Slow	271
4	Mr. Green	145	170	Fast	328
	Mr. Green	145		Slow	393
4a	Mr. Green*	145		Fast	428
	Mr. Green	145		Slow	491
5	Mr. Anderson	166	No test	Fast	327
	Mr. Anderson	166		Slow	397
6	Mr. Gunderson†	170	210	Fast	360
	Mr. Gunderson	170		Slow	340
7	Mr. M. Ormseth	127	170	Medium	460

* This individual had not pulled exactly in the desired position in the previous test and the test was therefore repeated.

† This individual had a slight injury to one arm just before the two-hand pull, which accounts for its relative inferiority to his one-hand pull, in which he was able to exert his full strength.

The two-hand pulls were only roughly comparable with Suzette's on account of lack of perfect homology in the attitude, but the one-hand pulls were made in a practically identical position. The results were as indicated in the table of one-hand and two-hand pulls.

In considering the above data one fact is very significant, that these men, used to hard manual labor, had to use a folded cloth in the palm of the left hand (which held to a fixed support so that the full strength could be developed, otherwise the person would just have pulled him-

self up to the apparatus by his right hand) to prevent the fixed support from cutting the hand.

The author endeavored to use a fixed support as closely as possible comparable to the sharp cornered steel door frame which Boma held with his left hand during his pull, and was struck by the fact that while Boma's horny fingers could hold onto a fairly sharp cornered metal piece during an 847–pound pull these men with all the calluses developed on their palms by farm labor could not exert their pulls ranging from 147 to 210 pounds without the above mentioned protection.

In order to make a just comparison with the two series of tests it was necessary, of course, to reduce to an equal weight basis. Inasmuch as the small number of anthropoid pulls only established the fact that the ape *could* pull the figures shown, simple averages were employed and no attempt was made to use biometric methods on the data.

Two-hand pulls reduced to basis of Suzette's weight

1. Fast $\frac{395 \times 135}{155} = 344$ pounds. Slow $\frac{368 \times 135}{155} = 321$ pounds.
2. Fast $\frac{380 \times 135}{140} = 366$ pounds. Slow $\frac{382 \times 135}{140} = 367$ pounds.
3. Fast $\frac{360 \times 135}{137} = 355$ pounds. Slow $\frac{271 \times 135}{137} = 267$ pounds.
4. Fast $\frac{328 \times 135}{145} = 305$ pounds. Slow $\frac{393 \times 135}{145} = 365$ pounds.
5. Fast $\frac{327 \times 135}{166} = 266$ pounds. Slow $\frac{397 \times 135}{166} = 327$ pounds.
6. Fast $\frac{428 \times 135}{170} = 339$ pounds. Slow $\frac{491 \times 135}{170} = 389$ pounds.
7. Medium $\frac{460 \times 135}{127} = 489$ pounds.

Suzette's superiority in strength, taking the fast pulls as most comparable

1. $\frac{1260}{344} = 3.66$
2. $\frac{1260}{366} = 3.44$
3. $\frac{1260}{355} = 3.55$
4. $\frac{1260}{305} = 4.13$
5. $\frac{1260}{366} = 4.73$
6. $\frac{1260}{394} = 3.20$
7. $\frac{1260}{589} = 2.57$

One-hand pull (right) reduced to basis of Boma's weight

1. $\frac{180 \times 165}{155} = 191$ pounds.
2. Not in this test.
3. $\frac{147 \times 165}{137} = 177$ pounds.
4. $\frac{170 \times 165}{145} = 182$ pounds.
5. Not in this test.
6. $\frac{210 \times 165}{170} = 204$ pounds.
7. $\frac{170 \times 165}{127} = 220$ pounds.

It is remarkable that only two out of five of these husky farm lads could approximate one fourth of Boma's pull, the position being fully as handy for man as for ape.

Expressing relative strength fractionally

1. Boma pulled $\frac{847}{191} = 4.43$ times this individual's maximum pull.
2. .....
3. Boma pulled $\frac{847}{177} = 4.78$ times this individual's maximum pull.
4. Boma pulled $\frac{847}{182} = 4.65$ times this individual's maximum pull.
5. .....
6. Boma pulled $\frac{847}{204} = 4.15$ times this individual's maximum pull.[1]
7. Boma pulled $\frac{847}{220} = 3.85$ times this individual's maximum pull.

The next step was to make an estimate, based on the proportion between the students' one-hand and two-hand pulls, of what Boma could pull with both hands; and then reduce this to an equivalent weight basis for a comparison with Suzette's strength. Fast pulls were used as the basis.

[1] Number 6, it may be remarked, was the captain of the football team and a line plunger noted throughout the state of South Dakota, yet he did not average quite one quarter of Boma's strength.

Ratios of two- to one-hand pull

1.	395 : 180 = 2.19	2.19
2.	Only in one test.	2.45
3.	360 : 147 = 2.45	1.93
4.	328 : 170 = 1.93	2.04
5.	Only in one test.	2.71
6.	428 : 210 = 2.04	
7.	460 : 170 = 2.71	5)11.32

2.26 average ratio between two- and one-hand pulls

$847 \times 2.26 = 1914.22$ pounds. (*Boma's estimated two-hand pull*)

$\frac{1914.22 \times 135}{165} = 1566$ pounds. (*If Boma weighed as much as Suzette*)

$$\frac{1560}{1260} = 1.24$$

Boma therefore appears to be 1.24 times as strong weight for weight as Suzette; as he is, his comparative strength comes out $\frac{1914}{1260} = 1.52$. He is half again as strong as his mate therefore. It is of interest to note that the figures 1.24 for relative and 1.52 for absolute superiority in strength are very common ones for human couples.

The third objective is pregnant with scientific interest. First since chimpanzees are so much stronger weight for weight, and also muscle girth for muscle girth, than men, to what factors do they owe this very striking superiority? Is the chimpanzee muscle of superior contractile quality square centimeter for square centimeter? Or is superior nervous stimulus exerted on the muscle fibres? Or is it partly one and partly the other? These questions are fraught with the greatest interest to the physiologist; a three or four to one difference certainly demands an explanation. No one could attribute it to exercise in comparing long captive chimpanzees with students fresh from strenuous farm labor.

Heredity suggests itself immediately, and rightfully so, but as the exigencies of an arboreal life in which strength is a prime asset have probably resulted in natural selection maintaining this high strength level, the further question suggests itself: Did our own arboreal ancestors possess a comparable strength, and if so at what period did such a high degree of strength cease to be an object of stringent selection and gradually diminish to a lower level? Furthermore heredity and selection might explain the original acquirement and subsequent transmis-

sion of such strength, but they leave the physiological problems of its immediate causation unexplained. It is the physiologist who must deal with these.

Taking a comparative view we find that, making the necessary allowances for difference in stature and amount of cross-section of muscle in proportion to body weight, man compares favorably with many, probably with most, other animals. We rank considerably above the Ungulata, and the oft-cited strengths of the beetle and ant, when duly corrected as just indicated, appear to be materially less than our own. Probably cross-section for cross-section of muscle man stands materially above the bulk of the animal species. The animals out-ranking him it would seem are the Carnivora, the other Primates, and such animals as the mole, etc.

It would be an experiment both interesting and valuable to test the relative strength of the Felidae and the chimpanzee and orang, in order to determine which is entitled to the rank of greatest strength in the animal world per unit area of muscle cross-section. The author has thought of doing so himself, but the practical difficulties are immense in the case of the Felidae. Milo Hasting's statement is a true one that: "The cat tribe and man seldom if ever test their powers save in a manner in which weapons and not strength decide the issue."

The power of blow of the paw of a lion or tiger might perhaps be measured with a specially constructed apparatus and the power of spring by an arrangement of a net attached to a dynamometer dropped over the beast in the act of springing, but, difficult as this would probably prove to do, homologizing of the result with those of tests on the Primates bids fair to be a greater problem.

The last question raised by the strength of the chimpanzee seems to have been *completely* overlooked in the past. All anatomists place reliance upon the relative development of the various muscle attachment ridges and pits on the bones as a trustworthy indication of the strength of the owner.

Yet anyone who will take the trouble to compare carefully the crest of the ilium of the chimpanzee with that of the human being will notice that the muscle attachment roughnesses are very markedly less prominent in the former than in the latter, yet Suzette's pulls have clearly demonstrated an immense superiority in strength of the lumbar region in the ape. Also with regard to long sustained action, a short time spent in the anthropoidal posture will convince any person that this pos-

CHIMPANZEES UPON WHICH STRENGTH TESTS WERE MADE

Upper left figure: "Johanna," Philadelphia Zoological Garden. Upper right figure: "Suzette," New York Zoological Park. Lower figure: "Boma," photographed by E. R. Sanborn, New York Zoological Park.

ture calls for more taxing long sustained action of the lumbar muscles than does the erect posture of the human being.

We certainly can not look to man's erect posture for an explanation of the smooth sharp rim of the hip bone in the anthropoid ape, why then do the usually so reliable muscle attachments fail here to correctly indicate relative strength? The discrepancy is an extremely pronounced, not a trifling one, moreover.

And finally, how about those interesting Neanderthal men? We customarily base our estimate of their probable strength upon the degree of prominence of their muscle attachments as observed in the fossil bones—but should not the above consideration incline us toward caution in this class of inferences, particularly when the subjects are an ancient race known to have approximated closely to the anthropoidal type in their anatomy—as well as impel the comparative anatomist to a thorough investigation into the reason for this strange discrepancy.

Allentown, Pennsylvania.

NOTES ON THE MAMMALS OF NORTHWESTERN ALASKA

By Alfred M. Bailey and Russell W. Hendee

[*Plates 2–4*]

The expedition of the Colorado Museum of Natural History of 1921 and 1922 to northwestern Alaska was for the purpose of securing habitat groups of the birds and mammals of that interesting region. The large mammals of the Arctic coast of Alaska seem to be poorly represented in North American museums, and as it has been the policy of Mr. J. D. Figgins, the director of the Colorado Museum of Natural History, to represent "America First" in museum exhibits, we were sent north fully equipped for sixteen month's work beyond the Arctic Circle.

We left Seattle June 9, 1921, on the S. S. Victoria, and returned in October of the following year. Through the courtesy of Captain C. S. Cochran of the Coast Guard Cutter "Bear" we were able to visit King and St. Lawrence Islands in Bering Sea, and various points along the Siberian shore, and finally we were carried with our outfit to Wainwright, the town selected for our winter base. This little Eskimo village of some thirty igloos lies within one hundred miles of Point Barrow, the northern-

most land in Alaska, and is about two hundred and fifty miles north of the Arctic Circle.

The Bear dropped anchor at Wainwright August 6, our supplies were taken ashore in oomiaks, and the boat resumed her northward cruise. Hendee remained at Wainwright while Bailey continued with the ship to Barrow and along the three hundred miles through the pack-ice to Demarcation Point, the international boundary line on the Arctic coast. Collecting was carried on at various points en route, the Bear returning to Wainwright August 22.

The tundra about Wainwright is rolling and is dotted with innumerable small ponds and lakes. Vegetation is scant, mosses, lichens, and coarse grasses predominating, although dwarf willows a few inches in height clothe the sheltered hillsides. These willows attain considerable size inland along the river valleys where they are protected from the strong north winds. The mouth of Wainwright Inlet is a few miles below the village. This large body of water extends far inland and offers a convenient method of reaching the interior, via oomiak in the summer months and over the ice by dog sled in the winter.

There were many reasons for choosing Wainwright as our winter station. From the data we had secured, there seemed to be an abundance of sea mammals in the vicinity, and a possibility of securing the now rare caribou of the Arctic coast, as well as a group of polar bears. Then, the extensive coal seams along Wainwright Inlet assured us an abundance of fuel during the long winter in prospect. We found our base an ideal spot, all that we had anticipated, and we were especially fortunate in finding Mr. James Allen in charge of the trading post at Wainwright. Allen is a veteran of the Arctic, having lived along the coast for twenty-five years, and he was able to help us in many ways. We are also indebted to Mr. Charles Brower of Barrow for his interest in making our work a success.

The first snow fell in late August and from then on flurries were the usual thing, although freezing weather did not occur until the middle of September. Ice conditions are always a problem in the north, for the sea mammals usually accompany the "old-ice," as the permanent field which floats back and forth with the current and wind is called. We eagerly watched the horizon when favorable winds blew, but cold weather set in and froze the ocean with no sign of the Arctic "pack" appearing. As a result, hunting was very poor during the fall. The conditions were reversed the next summer, however. Adverse winds, which blew continually, kept the ice crowded along the coast leaving

few leads along which the whales, walruses and seals could migrate, while the polar bears were still with the old ice far offshore.

The weather at Wainwright was not severe, 44 degrees below zero being the coldest registered by our minimum thermometer (the thermometer being buried under a snowbank most of the time). The sun disappeared below the horizon on November 20, not to appear again for over two months. During this time we had days of wonderful weather when there was scarcely a breath of air stirring; cold, quiet days when the sombre tundra was lighted by the moon and a myriad of deep-set stars, ideal days for travelling with the dogs. Storms break suddenly, however. One night the aurora had been glowing overhead, great streamers of colored lights dropping from a broad arc, and a light wind had been blowing from the north. Without warning, the wind shifted to the south, increasing in violence until within an hour such a storm raged that one dared not leave an igloo without a life line. Natives holding hands could not see each other for the drifting snow, and the fine, dry particles worked their way through two double windows, carefully calked with cotton, until several inches were deposited on the floor. There is little for the naturalist to collect in the Arctic during the winter months and our field trips during the dark days were limited for the most part to dog sled journeys in the vicinity.

When good travelling snow had packed the tundra, early in October, Hendee went far inland after caribou with an old native guide. They were gone into the barren country back from the coast for twenty-five days and secured a good series of the barren-ground caribou. Bailey and Allen followed up the coast the latter part of October to Point Barrow by dog sled, and Hendee made the same trip with Eskimos in January.

We particularly desired a group of walruses and as ice conditions are always uncertain along the coast, it was planned that Bailey should drop down to Cape Prince of Wales on Bering Strait in the late winter. This involved a continuous dog sled journey of 650 miles. He set out on March 12 with a native named Upiksom and a team of eleven dogs, and reached Point Hope, 250 miles from Wainwright, in six days. The dogs were rested and then they continued three days more to Kivalina. Upiksom returned to Wainwright while another relay of fourteen dogs was secured for the three-day trip to Kotzebue. The remainder of the way to Cape Prince of Wales was made with two teams of seven and eight dogs and on this part of the journey Bailey had the unique experience of travelling overland with "George Washington" and "William

Penn," two Eskimos named by Quaker missionaries. The run from Wainwright to Wales took but eighteen days travelling and was made without accident or hardship.

Weather conditions at Wales are not favorable for the collector, for strong winds make work along the shore ice extremely hazardous, and collecting upon the tundra unprofitable. The ice of Bering Strait is constantly churning back and forth with the shifting currents in April, and aside from an occasional ringed seal no mammals are to be seen. Early in May, however, the currents begin to run steadily to the northward, and the migration of sea mammals begins. From this time until the latter part of June, when weather conditions are possible, the Eskimos are continually afield.

Bailey accompanied a crew of natives on every offshore excursion during the hunting season, and so had an unusually good opportunity to note the mammals on their northward drift with the ice. The natives at Wales use rather small oomiaks covered with walrus skins for hunting whales, and much larger boats for walrus hunting. Two trips were made across the straight into Siberian water and on each occasion the boat, filled with meat, made the return to the village through heavy seas which speaks well for the seaworthiness of the native boats. As the currents run north continually, and these skin boats are too bulky to paddle against wind and tide, it is necessary to hunt on a north wind, that the boats may be sailed back to safety. Weather conditions are watched with interest, as an unfavorable wind results in the entire crew being carried northward with the drifting pack into the Arctic Ocean.

In the spring months at Wainwright, Hendee went far out on the ice with Allen and the natives to hunt the bowhead whale. They pitched their camp on the edge of the "flaw" (where the sea ice breaks from the grounded "shore ice") and then hunted for a month, during the height of the migration of the sea mammals. They took three whales and many seals.

The collector in the north must hunt with the Eskimos if he desires to secure a really representative collection of birds and mammals. The Eskimos are a sturdy, honest people, and are to be relied upon, but they are very independent, and unless the collector is willing to accompany them in the field and share their hardships, he will have poor success.

We wish to acknowledge the many favors extended us by the people of the north, especially to those mentioned above, to Mr. and Mrs. Thomas Killeen of Wales and to Mr. W. T. Loop of the Alaska Division of the Bureau of Education; also to the trustees of the Colorado Museum

of Natural History, and to Mr. J. D. Figgins, the director of the museum, who made the trip possible. His aim has been to represent groups of North American wild life *first*, and that his work has been successful is attested by the remarkable series on exhibition. On our return, Dr. E. W. Nelson and Dr. H. H. T. Jackson of the Biological Survey were so kind as to identify our doubtful specimens.

The following observations are the combined work of A. M. Bailey, the leader of the party, and R. W. Hendee. By way of apology we wish to remind the reader that we were in the north to secure exhibit material and that extensive collecting of small mammals was impossible; furthermore, the collector is limited to a few months open season in the summer and fall, and again a short two months in the spring.

Sorex cinereus hollisteri.—Arctic Shrew. Hendee secured a specimen of this species on the tundra near Wainwright on April 4, 1922. Another was observed during the first week in October about fifty miles inland from Wainwright. It was driven to the surface of the snow by the approach of the dog team and was snapped up by the leader.

Ursus alascensis.—Alaska Grizzly. Bailey secured two skins of this bear taken in the interior near the head of the Noatak River. The skulls were not obtained. He was informed that the animals were not uncommon and that a few were killed each year by the Eskimos. In reply to an inquiry the following information was received from the Biological Survey: "The Barren Ground Bear found about the headwaters of the Noatak River is probably *Ursus alascensis*. We have no specimens from that locality, but this is the best guess we can make at the present time." The trappers and traders of the region recognize a grizzly from the wooded country which they distinguish from the barren-ground bear. A few of these range back of Wainwright and in the previous year one was taken back of Icy Cape. Bailey secured a skin which was taken near Port Clarence.

Ursus americanus.—Black Bear. Traders at Kotzebue had skins of this bear which they claimed to have received from the region of the Kobuk and Selawik Rivers.

Thalarctos maritimus.—Polar Bear. The polar bears live on the drifting pack ice and when unfavorable winds blow the ice far offshore but few are taken by the coast natives. Such was the condition at Wainwright. The old ice failed to come in in the fall and new ice formed for miles out from the shore. Consequently few bears were killed between Barrow and Point Hope. When Allen and Bailey were on their way to Barrow they followed the tracks of a female and two cubs but the three animals were killed by a couple of Eskimo boys before we were able to overtake them. A half dozen bears were killed at Icy Cape and Wainwright, about the same number at Barrow, and possibly a dozen at Point Hope. Seven were taken at Wales during the winter. On his sled trip of six hundred and fifty miles, Bailey did not see a single track, so it will be evident that polar bears are not always abundant.

When a walrus or whale carcass becomes stranded on the beach, however, the animals are likely to be found about it in considerable numbers. Two years be-

fore our visit a case of this kind occurred a few miles north of Wainwright. In telling Hendee about it, Kogmuk said that he and Waluk saw a bear and shot it, then another and another appeared until they had killed eleven. In 1913, when making an overland trip from an ice-bound whaler, Allen and his Eskimo companions came upon the carcass of a whale at Pitt Point. About it they counted twenty polar bears and nearly a hundred white foxes. The latter were not prime but were so tame they could be killed with sticks. As the party had but four rifle cartridges they killed only two bears, saving the other two cartridges for an emergency.

One of the most interesting cases is the experience of Captain Williams whose ship was frozen in at Cape Perry, east of the Mackenzie, in 1896. One afternoon Captain Williams came on the remains of a stranded whale about which he saw a number of bears. After returning to the ship for a supply of ammunition he hid himself near the whale and killed thirty-five bears in the course of the afternoon.

Allen told us of killing a bear at Herschel Island which walked almost into a ball ground while the men of the stranded whaling ships were playing baseball. The bear was coming down the wind and did not receive any warning until it was shot. Upon examination it proved to be blind. The blindness was seemingly of long standing, yet the animal was fat and in good condition.

The big male bear used in our group was killed by a girl at Icy Cape. She and her husband-to-be were about to start to Barrow to be married when they heard a commotion among the dogs outside and she crawled out to investigate, taking her rifle with her. At the cache stood this magnificient bear and a single shot made old Nannuk into a fine museum specimen.

Togaruk, one the Wainwright hunters, came upon a female bear with a large cub on the ice. The old one was watching a seal hole while the cub dozed in fancied security. After shooting the mother without waking the youngster, Togaruk walked up to within a few feet of the cub and killed it as it slept.

Bears are usually encountered at unexpected moments. After his many years in the north, Allen, of course, has many interesting stories to relate. On one occasion he was trapping below Point Hope and had some traps set about a stranded walrus. A few days before he had caught a large white dog in one of these traps and had had some difficulty in releasing it. While crossing the sandspit on this day he was disgusted to see the dog in the trap again. He was tired, but plodded over to liberate the dog, walking with head down, until, when very close to the spot, a hoarse growl caused him to look up. The dog proved to be a large bear which was feeding on the carcass. The animal reared on its hind feet, towering over Allen who worked desperately to get the rifle off his back and out of the case. The hammer caught in the lining of the case and in trying to remove it he accidentally discharged the weapon, causing the bear to take to its heels. Allen said he did not feel at all bad about losing that bear.

The females usually have their young in February or March, according to what we were able to learn from the Eskimos, the old bear at that time usually retiring to a den in the pressure ice, where she is frequently snowed over.

These bears do not appear to be very savage, although when wounded they sometimes make desperate efforts to reach the hunter. Charles Brower told us of seeing an Eskimo fire a load of heavy shot from a shotgun at two bears near Point Hope. One of the animals ran away, while the other, which had been

wounded, charged. The man started to run but the bear overtook him and crushed his skull with a single blow of its paw.

Polar bears do not seem to come through Bering Strait in great numbers with the ice in the spring, as the natives of Wales do not see many and kill very few at that time. Bailey did not see a single bear there during the spring hunt, though a few were seen at the same season at Wainwright.

Mustela rixosa eskimo.—Eskimo Weasel. These little weasels were not abundant and we did not see a specimen at our northern station. The traders at Kotzebue had a few skins which they had secured from the natives of that region. At Wales the Eskimos said that they were often seen about old deserted igloos. Bailey secured one specimen in its summer coat at Cape Prince of Wales.

Mustela arctica arctica.—Arctic Weasel. These animals were not common at Wainwright but the natives brought a few to Allen with their other furs and we secured a native made skin taken in the summer. Hendee saw their tracks occasionally along the river at some distance from the coast in October. A few are taken at Barrow, and Bailey saw a good many skins at Kotzebue. The traders told him that the women trapped for ermine. Bailey shot one specimen at Golofnin Bay on July 26 and a number of others were seen at the same place among the huge boulders which line the beach.

Gulo luscus.—Wolverine. These animals were very scarce in Arctic Alaska. Atalayak, one of the Wainwright men, trapped one along a river about fifty miles inland from the village in 1921, and a couple were taken by the Eskimos of Point Hope. A few are taken each season between Point Hope and Barrow. The skins of these animals are held in high esteem by the natives, the one with the most wolverine trimming being considered the best dressed. A good wolverine skin will exchange for three or four white foxes and practically none of them are shipped out of this part of Alaska.

Vulpes alascensis.—Alaska Red Fox. Red foxes were taken rather commonly by the natives of Icy Cape, Wainwright, and Barrow, which proves that the species has a regular distribution along the Arctic coast. They seem to prefer the willow-grown river valleys away from the ocean. Hendee saw a few red and cross foxes while hunting caribou, and Bailey observed one red near Cape Beaufort. The fur of this species is usually much worn on the haunches from the habit of sitting on the snow, a condition which is much less noticeable in the white fox. Cross foxes of various grades were occasionally taken by the trappers but only a few in comparison with the others. On this trip down the coast Bailey saw many tracks of red foxes which are noticeably larger than those of the whites. Some of the Eskimos pretended to distinguish black or silver foxes from the reds by the tracks, but this is scarcely credible.

Vulpes lagopus innuitus.—Arctic Fox. This is the commonest fox along the Arctic coast and their skins furnish the greater part of the wealth of the Eskimos. Between a thousand and fifteen hundred skins are brought to the station at Barrow yearly, and we were told that the station at Demarcation Point secured a thousand skins during the year we were in the north. These foxes are trapped about the beached carcasses of sea mammals, or in baited traps on the tundra, and do not seem to possess the same cunning in avoiding traps as the red foxes. Their protective coloration makes them very difficult to see in the winter. We often saw their tracks far out on the frozen Arctic, and while hunting in the spring

at Wales, Bailey heard them upon the drifting pack. It was at midnight, when the oomiak was drawn out on the ice and the men were walking back and forth for warmth, when he heard this strange cry, the weirdest and most lonesome sound imaginable.

The Eskimos say the white foxes travel great distances on the floes. They would probably have little difficulty in catching eider ducks at that season. The natives give them the name of *p'shuko* (run around).

Lynx canadensis mollipilosus.—Canada Lynx. Lynxes are often taken in the willows of the barren country back of Wainwright, and Allen says that a hundred or more skins are sometimes brought to the station at Wainwright in a single year although none were taken during our stay. Bailey saw skins at Kotzebue which had been brought in by the trappers of that vicinity and from the wooded rivers emptying into the sound. While the numbers of lynxes taken seems to vary in a more or less regular way, it is remarkable that there are frequent periods when none at all are taken or reported from the country around Wainwright and Barrow.

Phoca richardii pribilofensis.—Pribilof Harbor Seal. Harbor seals were fairly common in the extensive lagoons near Icy Cape and Atanik, near the Sea-horse Islands. Most of our specimens were taken at the former place. The animals average considerably larger than the ringed seals, and the skins, which are heavier, are often used for making kyak covers. Upiksom reported seeing about fifty of these seals on a small ice cake, so crowded that they were heaped one on another. The "kasageuk," as they are called by the Eskimos, vary considerably in color; some show but few breaks in the silvery ground color while others are beautifully marked and well deserve the name of "spotted seal." Their broad, round muzzles serve as an effective field mark for identification and contrast greatly with the pointed noses of the ringed seals. The bulk of this species is migratory, passing through the strait into Bering Sea each fall. Their sharp, delicate claws are not to be compared with the heavy ice-cutting instruments of the ringed seals. Occasional examples of this species are taken by the Eskimos in the winter.

Harbor seals were very abundant at Wales in June and on the sixteenth of that month, Bailey, while hunting along the edge of the shore ice, had an unusual opportunity to observe some of them at rest on the ice. A wind was blowing toward shore, so that the pack ice ground against the stationary shore ice, leaving occasional holes in which seals were frequently to be seen. On the moving pack ice he saw three seals, two adults and one youngster. The old ones were trying to rest but the young one seemed anxious to play and insisted on nipping at the flippers of its mother. She would turn over lazily and waddle after the youngster, which would then run to the water's edge. The performance was repeated several times and finally the old one changed her tactics and boxed the baby with a well aimed flipper, thereby discouraging further play. A good many young of the year, which the natives said were about three months old, were taken at this time. The skulls of our specimens were identified by the Biological Survey as belonging to this species.

Phoca fasciata.—Ribbon Seal. According to Nagozruk these seals are rare at Wales although a few are seen and one or two are usually killed each year. Most of the hunters there have clothes bags made from the skins of this beautiful

species. Only two were seen at that point during the spring hunt, one on June 15, when the harbor seals were moving northward in great numbers, and one on June 26. Both were out on the ice and Nagozruk spotted them from afar as being ribbon seals. Unfortunately, Eskimos do not distinguish between individuals, and Bailey could not persuade them to forego shots at seals close by in order to obtain a doubtful shot at a seal on the ice, so not a single fresh specimen was secured. He did obtain some skins from the natives, however, one of which is used as an accessory in the polar bear group. We did not hear of any of these seals to the northward, though Murdoch reports a specimen from Barrow.

Phoca hispida.—Ringed Seal. The ringed seal is the common seal of the Arctic and seems to be resident along the entire coast, although the spring and fall movement of the species as observed at Wales proves that many individuals move southward with the pack. During the winter months the Eskimos secure a number by watching at the open holes caused by the action of the ice, and often they will sit by a hole for hours at a time, in weather thirty or forty degrees below zero, with never a shot to reward them for their patience. At times the seals are present in great numbers and we were told that hunters would sometimes kill thirty or more in this manner in a single day. During our stay, however, comparatively few were taken.

In January we secured large specimens and often found young almost fully developed in the females. In the spring none but small males were taken at Wainwright and inquiry revealed that newly born young were almost never seen. Many of the hunters were questioned and only one reported seeing a specimen in the long white fur found on those taken from the females in the winter. While working along the edge of the heavy ice the natives were continually watching for "nuk-chuck igloo," or hauling out places of seals under the ice. Fox tracks sometimes lead the hunters to such places, which, they said, could be smelled for some distance.

When young ice forms, the seals keep breathing holes open and in the spring days bask in the sun at the top of the holes to which they can instantly retreat in case of danger. Many were formerly secured with harpoons as they rose at the holes to breathe. A few are still secured there by netting, but it is only the "old time" Eskimos who have the necessary patience and skill for this.

In the spring, seals were occasionally seen sleeping in the water, floating along on their backs with their noses held well above the surface. Many of them appeared to be very curious and would rise repeatedly to watch the men on the ice. These, however, seemed always to be the younger animals. The old males, distinguished by their dark faces, were very wary and seldom appeared again after they once sighted the hunters. This difference is so noticeable that these dark-faced animals have been thought by some to belong to a different species.

The ringed seals were common at Wales whenever the ice was near. There was a pronounced northward migration in June and on the 26th Bailey saw a band of about twenty, which contained fifteen of this species, four harbor seals, and a single ribbon seal. The ringed seals possess very heavy claws which are doubtless of great use in keeping open the breathing holes in the ice.

Erignathus barbatus nauticus.—Pacific Bearded Seal. These large seals are of the utmost importance to the Eskimos of the Arctic coast for it is from their hides that most of the oomiak covers are made at the villages north of Wales, at

which place walrus skins are generally used for this purpose. This animal is often called "mukluk seal" since it furnishes the soles for most of the "mukluks" or boots. According to our observations they are not very abundant though some are taken at Wainwright throughout the year. Comparatively few are seen in the winter and most of them appear to be migratory.

At Wainwright some of these seals are taken on the ice about open holes and leads, while others are secured in the summer around the floating ice. At Wales practically all of them are taken on the drifting pack, either while they are basking on the ice or swimming slowly along the open leads. They are wary, and difficult to approach when upon the ice, and take to the water, at the slightest suspicion of danger. When alarmed in the water, they dive with a great splash, caused by striking the rear flippers on the surface. They are often seen cruising along, half curving out of the water, porpoise like, as though from sheer enjoyment. At other times they swim slowly with nothing but the muzzle exposed. On one occasion, while hunting at Wales in the spring, Bailey heard a queer strangling note coming from the depths, just after an "oogrook" had sounded, and the natives said the sound was made by this animal.

At Wales the bearded seals started northward in numbers early in June, 1922, and a few were seen on almost every trip offshore. The females were often accompanied by young which were surprisingly large for their age.

That the life of these seals is not always peaceful was clearly shown by a large male which Bailey took at Wales. Its back and belly showed long scars where the claws of a polar bear had cut through the skin. The Eskimos stated that they often killed seals which had been marked by old Nannuk. It is difficult to secure good museum specimens of this species in the spring at Wales for the majority of the adults are shedding their hair and are worthless for mounting.

Odobenus divergens.—Pacific Walrus. These large mammals were greatly desired for our series of North American habitat groups and it was to collect this species that Bailey made the six hundred and fifty mile sled trip from Wainwright to Cape Prince of Wales. Early in June great bands of walruses start migrating northward through Bering Strait. Whenever favorable weather prevails the Eskimos go offshore in their skin boats to hunt, as they are dependent on the sea mammals for their food and clothing.

The first walruses were seen on May 28, 1922, when three were taken by the villagers. After that date they were noted whenever an excursion was made into the drifting pack. As daylight is practically continuous at that season, Bailey, with his crew of a dozen men, would go out and remain until they had filled the oomiak with meat or were driven ashore by unfavorable weather.

The cows and calves migrate first, going through the strait a few at a time or in large herds, while the large bulls may be looked for about the middle of June. There are still a great many walruses, though they are not be compared with numbers of which Nelson writes (1877–81). There were three weeks of bad weather during June, during which it was impossible to launch a boat, and on one occasion walruses were so abundant that Bailey could hear their bellowing when he was two miles back on the tundra.

They are big ungainly brutes and entirely unsuspicious so long as one remains down wind from them. The Eskimos talked and made little effort to conceal themselves while stalking a band of large bulls, saying that it made no difference so

long as the walruses did not get their scent. They are usually harmless enough, but a female with young is apt to be savage. The Eskimos feared the young bulls most, however. The year before Bailey's visit a young male ripped a hole in the cover of a skin canoe, the damage being repaired only by the resourcefulness of Nagozruk, who immediately thrust the lungs of a slain animal into the gash. On this occasion a very large herd of walruses, at least three thousand, surrounded the heavily loaded boat. They were migrating through the strait at the time and the Eskimos had to stand by with oars and harpoons, shoving the animals off, while Nagozruk stood in the bow and shot "over four boxes" (eighty times) at heads which came too close for comfort. Mr. Figgins relates a similar experience while hunting with Peary in Greenland.

When Bailey killed the big bull which is to form the center of our group another broke water so close that he could have touched it with his rifle. As it rose from the water its tusks were on a level with the gunwale of the boat. Unless a bullet reaches the brain, a walrus is a hard animal to kill, and many wounded ones escape to perish later. "Floaters" are often picked up by the natives, and at Wainwright we saw many dead animals which had drifted to the beach. The natives are wasteful of their food supply, shooting long after they have killed more than they can carry, being content to save only the ivory. Many animals which are shot in the water sink before they can be reached by the hunters. The specimens which we collected had without exception been feeding on clams and several species of invertebrates which they had secured from the bottom of the strait. As the clams were hulled and apparently fresh, we had all the ingredients of a clam chowder, a delicacy which the Eskimos immediately prepared.

Walruses range as far north as Point Barrow but evidently do not go far to the eastward, as Tom Gordon at Demarcation Point told Bailey they are rarely seen there. They occur regularly at Wainwright, usually in July and August, when the natives sometimes secure them in numbers. These huge brutes stay near the ice floes and if the ice is blown far offshore, as was the case during our first summer, few walruses will appear. On the other hand, if the ice is too closely packed, as in the second season at Wainwright, they will be equally scarce. Knowing such conditions to exist we did not take chances on losing out on our walrus group by confining our efforts to one station.

Mr. Charles Brower informed us that the few walruses which occasionally winter near Barrow become seal killers. In such cases the Eskimos make every effort to destroy the animals as they drive away the seals and ruin the hunting. Very few, however, remain in the Arctic during the winter, the great majority migrating into Bering Sea where they live along the edge of the ice to the southward of St. Lawrence Island. In the spring, after the currents begin to drift through Bering Strait, they move northward into the Arctic Ocean. That many of the young are born en route is proven by specimens which we collected at Wales, to which the umbilical cords were still attached. Walruses evidently shed their hair in patches during June and July as we found the hair loose in all animals taken, with a new growth underneath the loose epidermis.

The natives at Wales use the skins of walruses for canoe covers while the skins of the bearded seals are used for this purpose from Point Hope northward. The Eskimo women at Wales are able to split the bulky hides to a suitable thickness for such use, whereas those farther up the coast are unfamiliar with such work.

Walrus skins are also used for dog food by the coast natives. The ivory is made into harpoon points and sled runners and is utilized for fancy carvings, many a fine tusk being carved into a cribbage board or a billiken. The average weight of the pair of tusks from a large bull is about ten or twelve pounds. Our largest set weighed seventeen and one-half pounds and Bailey heard of some which weighed twenty-four pounds.

Marmota caligata caligata.—Hoary Marmot. Marmots are fairly common throughout the hills of northern Alaska. The Eskimos told us they were numerous fifty miles inland from Wainwright. They are found in the foothills of the Endicott Mountains inland from Kotzebue Sound, and in the hills back of Nome. We saw skins taken by the natives of Wainwright and many others in the possession of the traders at Kotzebue. The skins are in demand for robes and parkas, as they are exceptionally light, warm and durable.

Citellus barrowensis.—Barrow Spermophile. These squirrels were common in many places from Nome to Barrow, and their colonies could be found on the higher mounds on the tundra near the coast. They were particularly fond of burrowing in the sides of old igloos, and the first two we secured were caught between the walls of a miner's shack near Nome.

There were several colonies just north of Wainwright from which we took a few specimens. One of the boys brought in two which he killed with a small shotgun a few days after they left their holes early in June. He reported that both of them had run toward him so savagely that he was frightened and ran away! They were still following him, he said, when he turned and killed them! At this season the animals were still in good condition and showed no ill effects from the long winter under ground. A number which were kept as pets about the village were fed entirely on meat.

At Wales they were common on the hillsides, first making their appearance through tunnels in the drifts long before the snow had melted from the flats. They were noisy and often attracted attention when they might have passed unnoticed. On one occasion Bailey saw a snowy owl carrying one in its talons. The skins of this species are much prized for making light parkas, especially for summer wear and for sled trips where the driver must run with the dogs.

We saw a species resembling this on St. Lawrence Island but did not secure examples. Specimens which we submitted to the Biological Survey from Barrow were identified as *barrowensis*.

Castor canadensis.—Beaver. There are beavers about the lakes close to the Kobuk River. They have been protected for a few years, and have increased in numbers, but a few seasons of trapping will undo the years of protection. The Eskimos claim to be able to distinguish the sexes in the water because the males swim with the head held high while the females slide along almost submerged.

Lemmus alascensis.—Alaska Lemming. This species was fairly common at Wainwright and we secured a few specimens during the fall and winter months. The boys often brought them in alive.

Dicrostonyx rubricatus rubricatus.—Nelson's Lemming.—This appears to be the common form of lemming in Arctic Alaska and we secured a good series in different pelages and of different ages. They are curious little animals in their white winter coats and according to Brower make interesting pets. Their trails often led out on the ice of broad lagoons and onto the rough sea ice, and we were

continually crossing them when travelling by dog sled on the tundra. Specimens were taken at both Wainwright and Wales.

Microtus operarius operarius.—Tundra Vole. A few of these animals were taken at Cape Prince of Wales. The Eskimo boys caught a number in abandoned igloos and reported them very common.

Ondatra zibethica spatulata.—Northwest Muskrat. These animals are abundant in the ponds of the Kobuk valley, according to the traders at Kotzebue, and Bailey saw numerous skins in their possession. They are being trapped intensively since high prices prevail, and doubtless faster than they reproduce. The traders complain about the fur laws, saying that the rivers are frozen until June first and that they can expect only fifteen days trapping. They say there are no young by June 15, although the females are carrying young.

Lepus othus.—Alaska Arctic Hare. This species was fairly numerous on the tundra back of Kotzebue. After crossing the ice of Goodhope Bay, Bailey saw their tracks quite commonly on the south shore of Kotzebue Sound and secured a male near Shishmaref.

Lepus americanus dalli.—Dall's Varying Hare. The Eskimos brought these fine little hares in from the Kobuk and Noatak Rivers by the sack full, and Bailey secured a few specimens from them at Kotzebue.

Rangifer tarandus.—Reindeer. Reindeer were introduced into Alaska from Siberia by the Bureau of Education in 1892. The increase has been rapid and now all of the native villages have their herds of deer. The Bureau still controls the industry and has built up a fine system whereby the Eskimos are enabled to become reindeer owners and eventually may become independent herders. The deer were introduced to save the Eskimos from starvation, when the supply of wild game fails, and so far the plan has proved successful. With the continuation of the wise policy of Eskimo ownership the future of the people seems assured. The natives of the northern villages still depend to a great extent on imported deer skins for clothing and on the sea mammals for the greater part of their food.

Rangifer arcticus.—Barren Ground Caribou. Our party collected eight fine specimens of the barren ground caribou. Those submitted to the Biological Survey were identified as *arcticus*, the following explanation being given: "In regard to the identification of the barren ground caribou recently sent us we may say that the caribou of this group are so much in need of critical revision that we hesitate to give these specimens a definite specific name. A number of names have been proposed for the Alaskan caribou, which seems to be very closely related to *Rangifer arcticus* from the region of the Mackenzie. In the absence of definite knowledge regarding the true characters and standing of these forms, we believe it would be best to call the northern Alaskan animals also *Rangifer arcticus*. Preliminary comparisons that have been made between the animals of the two regions indicate that they are very closely related." Specimens from the Meade River, back of Point Barrow, have been described as *Rangifer excelsifrons*, but the status of this as a species seems doubtful from recent comparisons.

We arrived at Wainwright too late to get back into the interior with the Eskimos who go up the rivers each summer, but on their return several of the old timers reported they had killed deer. As they told us that the caribou work back toward the hills during the winter months it was evident that a long sled trip would be necessary in order to collect these now rare animals. In October, 1921, Hendee

made a long trip inland with an Eskimo hunter and a dog team and secured eight specimens. Sixteen animals were seen on the trip which covered twenty-five days. Including these, there were sixty-four carbou killed back of Wainwright during the year.

The Eskimos are good hunters and do not allow an animal to escape if they can help it, evidently taking no thought for the future. Their custom is to kill all that they can and to make their winter camp on the site of the kill, living on the meat while they trap. Nineteen caribou were killed by Atoyuk alone during this season, ten of them being in one band from which none escaped.

The caribou are now few in number as compared with their former abundance, but seem to have increased slightly since the whaling ships made such inroads on the herds. In 1901 the Eskimos inland were wiped out by the measles. One hundred and seventy-six natives were buried at Barrow, while the river people were practically exterminated. Such a drastic decrease in the number of the hunters could not help but have a beneficial effect on the game.

Kogmuk told us that in the old days the Eskimos sometimes dug pits in the snow, which they covered with a thin layer of snow, to form caribou traps. They also made snares of rawhide among the willows at the river crossings. In those days, he said, the caribou were so abundant that the Eskimos seldom went back into the hills to hunt, but waited at the fords of the rivers and killed the animals with bows as they crossed. Mr. Brower has also informed us that it was the custom to drive the herds into the water of the lake or lagoons and to kill them with spears from kyaks. The natives are excellent hunters and can crawl across the open ground while the animals are feeding, taking care to lie low whenever the animals raise their heads to look about. They sometimes put willows on their heads, like antlers, and crawl into the middle of a herd, imitating the movements of the animals as they approach. Often the whole band can be killed in this manner. The caribou pay little attention to a rifle shot, as Hendee had an excellent opportunity to observe, and seldom run straight away unless they actually sight the hunter. Nowadays the men wear shirts of white drilling when hunting bands with females and young; but when stalking a lone male this is removed, as they say the caribou mistakes them for wolves and will not run.

Caribou often come into the reindeer herds, where they are usually killed by the herders. There has been much said about the benefit of stray bucks which may improve the herds of deer, but they are never allowed to remain long. There are, however, some hybrids to be found in the northern herds.

The crossing of the two animals has another side, however. Large numbers of reindeer are constantly escaping the herders and joining the wild caribou. It seems that it will be but a short time until there will be no pure bred caribou along that part of the coast. Fifteen hundred deer were missing from the herds at Wainwright and Icy Cape at one time during our stay, and stray deer are sometimes killed by the caribou hunters among the wild animals. As the reindeer are protected, and the caribou are killed at every opportunity, the former will doubtless prove the dominant animal and in time overcome the caribou, with hybridization the inevitable result.

The antlers of the male caribou average larger than those of the male reindeer, while those of the female caribou are smaller than those of the reindeer doe. In the latter part of October the velvet was completely gone from the antlers of the

male caribou, the females still showed strips of velvet clinging to the antlers, and the young were entirely in the velvet. The tracks of the two species are different, those of the reindeer being much rounder and shorter than those of the caribou. The caribou has more white on the under side of the body than the reindeer, and has larger ears and longer legs, so that when seen in a herd of reindeer they appear much taller.

Ovis dalli dalli.—Dall's Sheep. We did not personally encounter this species or see any skins, but Joe Tuckfield of Point Hope told Bailey that he saw five animals on Cape Lisburne during the summer of 1921. This is well north of the Arctic Circle, and is the same type of country in which Nelson saw sheep (1881) at Cape Beaufort, which lies just to the northward. Tuckfield gave the information unsolicited, and it is doubtless reliable.

Balaena mysticetus.—Bowhead Whale. In the old days when a single head of whalebone was worth thousands of dollars, these whales were followed into the Arctic by fleets of vessels; in fact it was the pursuit of these animals which first took white men in any numbers to the Arctic coast of Alaska. At present, as there is little demand for whalebone and very few ships enter the Arctic, whaling for the bowhead is confined to the resident traders and the Eskimos, who hunt rather for the meat than because of the commercial value of the bone. The whales migrate northward in the spring as soon as the ice opens enough to let them pass. The first ones were seen at Wales in the latter part of April, a few days before they appeared at Wainwright.

The natives at Wales informed Bailey that many whales were formerly killed at that point as they passed through the strait, but the natives of that village are no longer successful whalers and the animals are rarely killed there.

The method followed by the natives and the few white men who still hunt whales from the ice is much like of that of the old Eskimos, except that the whale is killed by means of bombs where it was formerly hacked to death with stone lances. Before the coming of white men the whale was usually harpooned as it rose at the edge of the ice. Seal skin floats attached to the harpoon lines served to hamper its movements and keep it on the surface until it could be killed.

The weapons used at present are the darting gun, a combination harpoon and bomb gun which fires a powerful explosive bomb at the instant that the harpoon enters the body of the whale, and the shoulder gun, a heavy brass weapon used for firing bombs at nearby animals. Both are usually carried in the whaling canoes.

While many of the whales are still struck at the edge of the ice, as in the old days, they are also hunted in the open water where men in canoes attempt to run alongside the moving animals and strike them as they rise to breathe. Sometimes they are killed by the first bomb, but often they escape, usually taking a good part of the whaling gear of the boat. A seal skin float attached to the end of the harpoon line serves to locate the wounded animal after it dives.

Early in April, 1922, the natives of Wainwright began to overhaul their whaling outfits; paddles were made, lines were cut from seal skins and new covers were sewed on the whaling oomiaks. By April 26 everything was in readiness for the spring hunt. A road was cut through the rough ice to a point six miles out on the Arctic, and the canoes were put on sleds and hauled by the men and a few dogs to the scene of the camp. There was no water the first few days, so Hendee and Allen returned to the village until May 1.

Their camp was merely a cooking tent, and a wind break erected back from the open water, where the men could rest. The canoe was placed on a carefully prepared slide with bow projecting over the water, and a rampart of broken ice partially concealing it from the sea side. Two darting guns were always in the bow, one carried a harpoon with a long line attached, to which a float (made by inflating a large seal skin) was fastened. At the side of the harpoon or "iron" was the gun, so constructed as to fire a powerful bomb at the instant the harpoon entered the body of the whale. The "second gun" was exactly the same, except that no harpoon was used. In addition to the darting guns, two "shoulder guns" were used, heavy brass weapons which fired heavier bombs than the others. One of these was kept on the ice near the sled, to be used in case a whale rose near the camp, and the other was so placed in the canoe as to be conveniently used by the man behind the "boat steerer" who, paradoxically, sat in the bow and handled the guns.

During the night of May 5, while everyone tramped ceaselessly back and forth to keep warm, a pair of glaucous gulls appeared, flying slowly along the edge of the lead. The old men told Hendee that these were always the first creatures to appear after the leads opened, and that soon would appear "shishara," the white whale, and then "ahkalook," the bowhead.

The Eskimos reported several bowheads May 7, and they killed a large white whale. As this specimen was being "cut in," Hendee and several Eskimos stationed themselves by a large hole at the edge of the pack ice. His field notes read: "We had watched for about an hour without seeing so much as a seal when, with the suddenness of an explosion, a whale 'blew' about thirty yards south of us. Sagavon and Allen snatched up two guns and ran to try to head the animal and get a shot, but the whale had already passed us under water before rising, and though it blew six times at intervals of a few seconds, they were unable to get closer.

"The animal had come and gone so quickly that I had been able to gain only a confused idea of its appearance. However, I had a better opportunity for observation a few moments later. I was standing at the north end of the hole when a commotion attracted my attention. Within a few feet of me a great, black object, smooth and shiny as rubber, rose to the surface; with an explosive "whossh" it shot up a puff of vapor and then rolled leisurely out of sight. Sagavon and Jim grabbed the shoulder guns and ran to the edge of the hole, where they crouched, waiting. Half way between us the whale blew again, and as it went down the men rose to their feet and raised the guns. As it came up once more, directly in front of them, they fired simultaneously and the whale plunged from sight, flinging its tail high in the air as it went down. The bomb exploded an instant later but, though probably mortally wounded, the force of the animal's plunge had carried it under the ice and it was lost."

When whales are working along in fairly open water they rise regularly to "blow" and though no two animals will stay submerged for the same length of time, an individual will rise more or less regularly. The whalers take advantage of this trait, and when an animal is seen moving in the distance, its general direction, speed and length of submergence are noted, and the hunters attempt to head it off. According to Allen, if the animal remains down fifteen minutes, it can be looked for every fifteen minutes. This is a peculiarity which is a great help in hunting from whaling vessels, when the animals can be followed.

Eight more large whales were seen during the night by the natives stationed at different holes, and the following day several more were seen. Hendee's notes will give an idea of the thrill to be gained in "flaw" hunting for whales, and the disappointment which often comes. "Several hours later another whale blew in a small hole a few hundred yards to the south of us. Hoping it would blow again we took our places at the side of the canoe to be ready for action. However, nothing happened for so long we supposed the whale had passed us. Then, without warning, he rose very close and came leisurely toward us. As he blew for the third time he was directly in front of the shoulder-gun men and without waiting for orders, they fired, Jim immediately following with the other gun. The whale went down almost under the bow of the canoe and the boat steerer struck him through three feet of water. From under our feet came the triple roar of bombs as we seized the line and attempted to check the plunging animal. But, with a steady, irresistable motion the line ran out, forcing us to drop it to avoid being dragged into the water. As it ran out, a loop in the line entangled a paddle thrust through a lashing in the canoe. The oomiak turned on edge, the ice under it broke, and water began to pour over the gunwale. Then, as the paddle snapped, the canoe righted once more and the whale was gone."

On May 10 the wind strengthened and shifted to the east, so the men realized the ice would soon break at the "flaw" (wall where the grounded shore ice breaks away from the sea ice) and that if they were to kill at a hole they must do it quickly. Many whales were seen blowing at a large hole during the morning, and finally, when one came to the surface a short distance away, the men stationed themselves at the boat. "We had been seeing whales blowing all morning in a small hole a few miles to the southward and shortly after the ice began to break one of the men saw one rise softly to the surface in a pothole a hundred yards away. The old whalers in the crew believed it would rise again near us, so we took our places for what was likely to be the last chance for some time. Half an hour passed without even a whispered word, and we had nearly given up hope when the whale rose suddenly fifty feet from us, and coming rapidly. At the second blow it was directly in front of the canoe. Straightening our backs, we shot the oomiak forward, flinging it bodily onto the whale's head. As the canoe landed, Charlie, in the bow, came to his feet and struck the whale just behind the blowhole, Allen firing from the ice with one of the shoulder guns at the same instant.

"Charlie snatched the second gun and struck the whale again as he rounded to go down, then turned and flung the line to us on the ice. As we caught it and braced ourselves for the pull, the three bombs burst with a roar. As before, we were slid easily over the ice for a moment, but it was merely the force of the whale's last plunge. Before we reached the water the line began to slacken and we knew the whale was dead.

"Ordinarily the body of a whale will rise to the surface, but in this case it required all our strength to raise it sufficiently to enable one of the men to fasten another harpoon to the lip by which to tow it. When this had been done, we set to work with axes and whale spades to cut holes in the ice through which to pass the line. From hole to hole, a few feet at a time, we towed the great beast under the ice for a quarter of a mile before we reached the lead, and by that time we found we had another quarter of a mile of open water to cross before reaching the shore

ice. Other canoes had seen our flag, however, and came to help. With three crews paddling, we soon reached solid ice, though at some distance from our trail. By means of a long line, we towed the whale to this road, aided by all the boys, men and women of the village."

Many other whales were seen during the following two weeks, and two more animals were taken by the hunters at Wainwright, but the above notes are sufficient to give an idea of whaling as it is carried on in the Arctic. Much has been said about the scarcity of the bowhead, due to the persecution of the whaler, but Jim Allen, who has been hunting them for twenty-five years, declares they saw more whales during 1922 than he had ever seen before.

There is a small form of whale in Arctic waters which has long been recognized by whalers and Eskimos alike but which, zoologically speaking, appears to be unknown. The Eskimos call this animal "inito" and insist there is no mistaking it for the bowhead, or "ahkalook." James Allen and Charles Brower, veteran whalers, are equally insistent that this animal is distinct from the bowhead, to which it seems allied. Hendee had an opportunity to note the differences between the two animals, and his observations and information which he gained from Allen were corroborated and added to by Charles Brower, who has seen and killed many of both forms.

Unfortunately, it was impossible to save the specimen taken by Hendee and Allen, offshore at Wainwright, Alaska, May, 1922, so we have only a few poor photographs of the animal. Zoologists would, of course, be unwilling to name the animal on the statements of even such skilled hunters as Allen and Brower, so the following differences between the two whales are submitted, subject to future verification, without thought of offering a technical description. The external differences are as noted by Hendee, while the other notes were secured from Allen and Brower.

In comparing these two Arctic whales, the "inito" is said to be much smaller than the adult bowhead (averaging thirty-five feet or under in length) with a flatter head and without the characteristic "bow" of the large form. There is no trace of the "bonnet" of the right whale. The tail and flippers are much smaller in proportion to the size of the animal than in either the bowhead or right whale; the body is round and barrel like, and where the body of the bowhead is slender and tapered in front of the tail, that of the "inito" is round, almost cylindrical, a few feet in front of the "small." The "inito" is lighter in general color than the bowhead, and even in animals the same size, that is, an adult "inito" and young bowhead, the meat of the former is much lighter and finer grained. The bones of the "inito" are solid and very hard, the jaws and ribs being prized by the Eskimos for sled runners, whereas those of the bowhead are worthless for the purpose, being soft and spongy in the center and easily broken. In two whales of the same size the bowhead will have long whalebone which is heavy and black in color, while the bone of the "inito" will be much shorter, rarely exceeding two and one-half feet in length, and it will be very thin and light, and gray in color.

The "inito" then is a small, Arctic whale, rarely over thirty-five feet in length, which somewhat resembles the bowhead. It has a flat head without the characteristic "bow" of the large whale; its jaw bones and ribs are very hard; and the whalebone is thin and light, gray in color, and two and one-half feet, or less, in length.

FIG. 1. POLAR BEAR CUB. ICY CAPE, ALASKA. SEPTEMBER, 1921

FIG. 2. ARCTIC FOX. A MAGNIFICENT SPECIMEN, IN TRAP

FIG. 3. PRIBILOF HARBOR SEAL. MALE. WAINWRIGHT, ALASKA. SEPTEMBER, 1921

FIG. 4. RINGED SEAL. OLD MALE
Note black face, pointed muzzle, and heavy claws

FIG. 5. BEARDED SEAL. CAPE PRINCE OF WALES, ALASKA. JUNE, 1922

FIG. 6. PACIFIC WALRUSES. HERD OF FEMALES. BERING STRAIT
Photograph by Lomen Brothers

FIG. 7. BOWHEAD WHALE. SMALL INDIVIDUAL TAKEN OFF POINT BARROW, ALASKA
Photograph by Fred Hopson

UNIV. OF MICH.

While the "initos" are never very large, they are often larger than small bowheads, with which they are not to be confused. The natives claim to be able to identify these animals as far as they can see them, and each species is given its distinguishing name (a term to include both forms is never used). Brower told us the "initos" are usually easier to approach in the water than the bowheads, and experience at Wainwright seems to prove this. He also states that the calves of this species are never seen. These whales were recognized by the whaling captains but were seldom killed, as the whalebone was of too little value. The range of the "inito" is, of course, unknown, but in summer it inhabits the waters of the Arctic Ocean off the coast of Alaska, and as far to the eastward in the Arctic as the Mackenzie River.

Rhachianectes glaucus.—California Gray Whale. These whales are occasionally seen in the Arctic in summer, though none was noted in the early spring, when the bowheads were coming north in numbers. One or two were seen from the beach at Wainwright, where we were told they were never hunted, as they blow only once at each rising and offer the hunter no opportunity for a shot. At Wales, where they are often seen, the natives were afraid to attack them, as they had a bad reputation for destroying canoes. We were told that one of these animals, which are usually called "devil-fish," had smashed an oomiak at St. Lawrence Island a few years ago and drowned two of the crew. We saw three of these animals off Gambel village, St. Lawrence Island, July 1, 1921.

Delphinapterus leucus.—White Whale. These small whales are abundant at times along the Arctic coast, appearing in large schools in the open leads of the pack. At Wales the "beluga" started through the strait in the latter part of April and Hendee saw them first at Wainwright on May 9, 1922. The Eskimos say the first living creatures to appear in the spring are the gulls, the second the white whales, or "shishara," the third the bowhead, or "ahkalook," all three arriving ahead of the eider ducks. The white whales evidently remain in the Arctic until forced south by the ice, for Bailey saw bands near Barrow on October 28, 1921, at which time zero weather prevailed. The Eskimos are fond of the meat of the white whale, especially the skin which, like that of the bowhead, they eat in the form of "muk-tuk." The animals usually sink when shot and are often lost unless a harpoon can be driven into them as soon as they are killed. When shot near the edge of grounded ice they are often recovered by means of a weighted grapnell.

The "belugas" seemed to average between ten and fifteen feet in length, though Allen told us he once measured one which was twenty-two feet long. He also said that once, while hunting with an Eskimo at Point Hope, the man wounded a large white whale which rose a moment later at the edge of the ice and, sliding its head out on the ice, snapped its jaws a few inches from the man's legs. Allen was certain that this was a deliberate attack and not an accident.

Orcinus rectipinna.—Killer Whale. These whales are feared by the natives of Cape Prince of Wales and are never attacked by them. On June 26, 1922, after a spring of unsuccessful hunting, so far as large bull walruses were concerned, Bailey and his crew came on a herd of fine animals swimming through the light pack ice near Fairway Rock in Bering Strait. A school of killer whales was following the walruses, and though the latter were badly wanted, the Eskimos absolutely refused to attack them as they said they were afraid the killers would

mistake the oomiak for a walrus. They said that they had seen these fierce whales throw a walrus completely out of the water. On several other occasions killers were seen in the strait and Hendee found them fairly common at Unalaska in September. We did not observe them in the Arctic, but Brower told us that they were sometimes seen at Barrow. He said that a band of them once killed a bowhead near the village.

Phocaena phocaena.—Harbor Porpoise. Hendee saw a few of these animals at Unalaska in the latter part of September, 1922.

Elephas primigenius.—Mammoth. Mammoth remains are met with by the collector throughout the Arctic. We occasionally picked up bits of "elephant ivory" along the beach and the Eskimos were continually bringing in pieces of ivory and occasionally teeth which they had picked up along the beach or on the tundra. Several tusks and skulls have been found in the vicinity of Wainwright in the past. Bailey was told by a trader at Teller that he had received the tusks and teeth out of a skull which was found complete, and broken up for the ivory.

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THE INTESTINAL LENGTH IN STELLER'S SEA LION

By Earl Theron Engle

It has long been known to mammalogists that the intestine of the Pinnipedia is of very great length, but the following record adds a little to the meager data on the subject.

On May 27 of this year (1925) a sea lion was reported on the rocks near the Hopkins Marine Station on Monterey Bay, California, by several students from the laboratory. The animal proved to be an old female of Steller's sea lion, *Eumetopias jubata* (Schreber). It lay quietly on the rocks and was not disturbed by the approach of spectators. A large wound, about the size of the palm of the hand, and two smaller wounds, about three inches apart and four inches above the larger wound, were on the thorax. As the animal was averse to taking to the water and the injury was seen to be gangrenous, it was thought best to kill it for study in the flesh, and for the skeleton. Subsequent examination of the mammary glands, uterus and ovaries showed that the animal had not been pregnant this season. The teeth were very badly worn, two incisors being lost, and the canines were greatly eroded, indicating that it was relatively aged.

During dissection opportunity was taken to free the intestine of its mesentery for purposes of measurement. The stomach, 21 inches in length, contained about a quart of mucous and gastric juice, and two

handfuls of unidentified nematode parasites. The pyloric opening was small, and the small intestine was nowhere more than one inch in diameter. The large intestine ranged from two to three inches in diameter.

The body of the animal measured 7 feet from snout to tail. The length of the small intestine was 254 feet 9½ inches; the large intestine 9 feet 2½ inches; and the cecum 3 inches. The total length, exclusive of the cecum, was 264 feet. This is both actually and relatively longer than any intestine of which I find record. Snodgrass (1899) writing on the fur seal (*Callorhinus alascanus*) stated that "in a bull the small intestine measures in length a little over 100 feet; in a cow between 50 and 60 feet." In the same paper it is stated that the large intestine in the fur seal bull is 7 feet, and 2 feet in the cow. If a similar sexual

TABLE 1

Lengths of intestines

	SEX	SMALL INTESTINE		LARGE INTESTINE		TOTAL LENGTH OF INTESTINE		AUTHORITY
		feet and inches		*feet and inches*		*feet and inches*		
17-foot Balenoptera rostrata.....	?	85	6.0	8	3.0	93	9	Owen after Hunter
Rhinoceros indicus...	♂	65		25		90		Owen
Elephas indicus.....	♂	38		20		58		Owen
Otaria jubata.....	♀	60	2.5	4	9.5	65		Murie
Callorhinus alascanus	♂	100		7		107		Snodgrass
Eumetopias jubata...	♀	254	9.5	9	2.5	264		Engle

difference is present in the Steller's sea lion, the intestine of the male would be 500 feet long.

The lengths of intestines of a few of the larger mammals are given in table 1.

These data for the Pinnipedia form an exception to the generally accepted dogma that the ratio of body length to intestine length is greater in the herbivores than in the carnivores. In this female Steller's sea lion the ratio is 1:37.7.

In the absence of experimental data, opinions as to the possible significance of this great length of intestine in an animal whose food is composed of fish and squid (Starks, 1918, p. 237) must be left to those who have made a careful study of its habits. It would seem advisable, however, for marine mammalogists to place on record large series of such measurements as a basis for future studies.

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SOME HABITS OF THE WOLVERINE

BY GEORGE BIRD GRINNELL

In the JOURNAL OF MAMMALOGY for August, 1920, I published a few notes on the wolverine, adducing some evidence, printed and otherwise, to the effect that the wolverine climbs trees and attacks large animals. The note reported by Mr. J. Keele, where a wolverine attacked a moose, and a printed account by Martin Hunter, where one was seen clinging to the back of a caribou, seemed important. The late Ned Hollister urged me to bring together and print any further evidence that I might be able to secure about this species. Another note appeared in February, 1921, and I here offer something more received through correspondence and otherwise, which may perhaps help us to some further understanding of the life of this little known species.

In November, 1920, there appeared in the natural history columns of the *Montreal Herald and Weekly Star* a letter from A. S. Marshall, who stated that he had seen a wounded cow elk which seemed to have been hurt by a wolverine. Mr. Marshall had trapped for about forty years in the Rocky Mountains, from the Canadian line south to Colorado. He was a close observer and a man whose statements could thoroughly be relied on. My correspondent, W. F. Hill of Kendall, Wyoming, speaks of him in the highest terms, and gives me these facts about him. Mr. Marshall died in the spring of 1923. Mr. Marshall's letter follows:

> In the eighties I trapped on the headwaters of Green River, south of the Yellowstone National Park during several years. In going over my line of traps one day I noticed a full grown doe elk lying in an open space in the timber. At my approach she attempted to get up, but could not rise, and I found a hole in her back over the shoulders, where the spinal cord was entirely severed. There was

about a foot of snow on the ground and I saw the tracks of a wolverine that apparently had just left; probably I scared it away. I shot the elk to put it out of misery, then got a trap and set it at the carcass. I had no clog to fasten the trap to, so I fastened it to the neck of the carcass. The wolverine came back, got into the trap, dug under the elk, came up on the opposite side, fouled the trap so that the swivel did not turn, twisted its foot off and escaped. I caught it in the same trap near there, about two weeks afterwards. Besides the foot I took off, it had part of another foot taken off before it had tackled the elk.

Trappers' guide books will tell you that wolverines are very cunning animals and hard to trap. They are the easiest animals to trap I ever saw, provided your trap and chain will hold. They haven't a lick of sense about avoiding a trap. I will give you an instance of their desperate fighting qualities. A chum of mine, when hunting, came across a mountain lion, as they are called in the West (properly the puma or cougar). The lion was living but helpless. He shot it and on examination found it chewed and scratched in a terrible manner and one leg broken. There was some snow on the ground, showing the track of a wolverine. This incident looks remarkable when one considers the difference in size, for the lion is at least three or four times the size of his opponent. Wolverines can climb, as I have treed them with dogs, but the dog has no chance in a standing fight.

Mr. Hill says that he has never found the wolverine plentiful anywhere in the Rocky Mountains, but there are a few as far south as southern Colorado in the high mountains. He has never known of one in either Colorado or Wyoming at a lower altitude than 5000 feet, but this would not apply farther north, where the country is more heavily timbered and better watered. Dr. A. K. Fisher advises me that Mr. L. B. Crawford, who was in the service of the Biological Survey as predatory animal inspector for Colorado, told him that in 1919 a wolverine was captured at the head of Los Piños Creek, southeast of Silverton, Colorado. Mr. Crawford further stated that in 1918 several wolverines were taken between Meeker and Craig in southeastern Moffatt County, Colorado. These captures are the latest I have heard of for so far south.

Mr. Hill's experience seems to show that the wolverine is very solitary in disposition, for he says that even the half-grown ones seem to travel alone nearly all the time. This opinion is confirmed by Mr. W. B. Cabot, who has been so much in Labrador and has written so interestingly of that region. He declares that the young scatter after summer. He says also that the period of gestation is the same as in the dog, and that the young are born about June 1.

The usual gait of the wolverine is a jump like that of a mink or the martin, but occasionally, according to Mr. Hill, they will walk for a short distance, when the track is very much like that of the Canada

lynx, except that the wolverine being short-legged the tracks are rather close together.

There seems to be no question in the minds of those who know most about the wolverine but that it readily climbs trees, as testified to by Mr. J. B. Burnham, Mr. T. H. Bowler, former Northwest Mounted Policeman, and Mr. J. P. Holman. They all agree that in Alaska it is the common practice among people who cache food in trees to open tin coal-oil cans and nail them about the tree below the cache to prevent the wolverine getting support for its claws. Notwithstanding these precautions the wolverines sometimes get over the tin and rob caches in the trees.

Mr. Marshall on one occasion pointed out to Mr. Hill a pine tree into which a wolverine which had been caught in a trap had climbed and became entangled in the branches and had died before he found it. Mr. Hill writes me that from 1892 to 1906 he kept as a part of his fur hunting outfit a pack of trained dogs which he used for running bears, cougars, lynxes, wild cats, and so on. On several occasions he has treed wolverines with these dogs, and he has found that they can climb with about the same facility as a black or brown bear.

Of a case which happened in January, 1899, Mr. Hill says:

> I was running a trap line on the head of Green River about 50 miles southeast of the Yellowstone Park. One day I found where a wolverine had struck my line and had followed it for about two miles, and had robbed my traps of all the baits, as he went along.
>
> Then he came to a place where I had killed a moose sometime before, and had hung up the meat as high as I could reach. He was feeding here when I came, and had climbed up and torn down some of the meat. He had evidently heard me, as he had left on the run.
>
> I had three trained dogs with me and started them after him, and he treed only about one-quarter mile from where he had been feeding. He had chosen a very large spruce and had gone nearly to the top and was fully 80 feet from the ground.
>
> I shot him four times with a 22 rifle before he came down, but he was dead when he struck the ground. This was a very large male. I think their tree climbing is a matter of common knowledge among trappers who are really acquainted with them and have never heard it denied by trappers of any experience.

The death of the wolverine just described was noteworthy because this was the largest one ever killed by Mr. Hill; because of the great height to which it climbed, and because it chose for climbing a tree about 2 feet 6 inches in diameter at the base.

Mr. Hill, like Mr. Marshall, considers the wolverine easy to trap, and does not give it credit for the wisdom attributed to it in the books and by some trappers of the north.

The story of the cougar apparently wounded by a wolverine is generally believed in the region where it was reported. Mr. Hill states that he never heard anyone express any doubt of its truth.

That account reminds me of one related many years ago by Charles Reynolds, an old and thoroughly reliable friend, who was killed many years ago on the banks of the Little Big Horn River. He told me that, some time in the '60s, he got hold of two wolverines so young that their eyes were not yet open. He tried to rear these. One died, while the other flourished and became more or less tame. He never allowed it to be at liberty, however. On a certain occasion, a young man turned up who had a Canada lynx in confinement; and he proposed that the lynx and the wolverine should be matched in battle. The two animals were introduced into a large box and a crowd of miners and hunters prepared to watch the fight. There was no fight, however, for the wolverine almost at once got hold of the lynx and proceeded to eat it up. The defensive efforts of the lynx seemed to have no effect whatever on the wolverine. Somewhat later than this, the wolverine escaped.

The great strength and the persistence of the wolverine are interestingly set forth in Dr. R. M. Anderson's "Notes on Arctic Mammals" printed in Mr. Stefansson's "My Life Among the Eskimos." He says: "Hardly any kind of a cache can be made strong enough to keep out a wolverine if he has plenty of time to work undisturbed, for the animal is strong enough to roll away heavy stones and logs, gnaw through timbers, climb to elevated caches, and excavate buried goods. We lost a shot gun which was hung on a tree, carried away by a wolverine" (p. 524). "The most nearly wolverine-proof cache I have seen was constructed by an Indian near Great Bear Lake. It was constructed by finding four trees in suitable position to form upright posts at the corners of the cache, and cutting them off ten or twelve feet from the ground. The posts were notched on the inner sides to support horizontal beams and logs laid across to form a floor projecting two or three feet beyond each end. When filled up, the cache was roofed with a layer of heavy green logs three or four deep, too heavy for a wolverine to move and too deep to gnaw through if he succeeded in getting on top. The uprights are stripped of bark and made as smooth as possible. If the wolverine succeeds in climbing the upright posts, the projecting ends of the floor timbers prevent him from getting around to the top of the cache. Having no foothold, he cannot work at the bottom or side of the cache, and consequently one thickness of timber suffices for these" (p. 525).

Mr. Carl J. Lomen, who has charge in Alaska of great herds of reindeer and whose reindeer herders have opportunities to see something of the wolverine, tells me that his men report it a slow-moving animal, and that for this reason it is not feared by the reindeer. These are in danger from the wolverine only when they get into the wooded country. The men say that "a wolverine has been known to lie on a branch of a tree and drop on the back of a deer and secure its prey by biting in the neck." In a more recent letter he says: "Our chief herder in Egavik, Alaska, Ole Bahr, a Lap, stated that the wolverine will stalk reindeer when they are feeding in deep snow and will jump on the back of the deer and bite into the neck." Mr. Lomen also quotes the Eskimo as saying: "Bears are afraid of wolverine."

Mr. Lomen received from an Eskimo in his employ the following story, told the narrator, now perhaps 35 years of age, when he was a small boy, by his father: The father was out hunting for caribou when he saw at some distance a wolverine feeding on a caribou. He began to stalk the wolverine intending to try to kill it, but before he had come near enough to shoot, he saw a bear approaching as if to feed on the caribou. When the bear had come close to the caribou carcass, the wolverine attacked the bear and the two fought for a short time, when the bear went away and the wolverine returned to his meal. The Eskimo was more or less frightened by this fight and no longer cared to kill the wolverine. He retreated quietly. Later he returned to the place and tracked the bear, and after following it for a short distance, 200 to 300 yards, he found the bear dead. It had been disembowelled by the wolverine.

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NOTES ON A POCKET GOPHER IN CAPTIVITY

By Charles Eugene Johnson

On April 11, 1923, while at the University of Kansas, I captured uninjured a female pocket gopher (*Geomys bursarius*) which showed signs of being pregnant, and took the animal to my home where I placed it in a wire cage. After I had provided the gopher with food and plenty of soft dry grass for nesting material, the cage was covered with a mat so as greatly to subdue but not entirely to exclude the light.

The gopher soon had built itself a nest and then seemed quite at ease, though at night it would in the beginning seek about the cage for a way out. It evinced little fear when I came to feed it. At such times, when it was roused by the sound of the cage door being opened, it would quickly thrust its head out of the nest as if to investigate the disturbance. As soon as it emerged I would hold a piece of food matter up to its nose. This the gopher immediately seized, crawled back into its nest to store it away, and then returned for more. After a few feedings it began to come clear out of the nest to take the food from my hand at the cage door. It responded so promptly and with such apparent anticipation whenever I pushed open the cage door that I rated it as capable of learning rather quickly, and not difficult to tame. On these occasions it manifested no ill temper or tendency to bite, though this gentleness probably was chiefly due to the care that I exercised so as not to irritate or excite it in any way.

During the time that this pocket gopher was in captivity it ate freely of the following foods which I fed it: carrots, cabbage leaves and stalks, head lettuce, Irish potatoes, green apples, and the stems and roots of sweet clover. Of this list it seemed distinctly to prefer the fresh young roots of the sweet clover. Merely as an experiment to test its reaction toward foods with which it certainly had had no previous experience, I fed it at different times banana peel, sweet potato, canned pineapple, dried apricots, and fried egg. A rather small quantity of each of these things that I placed before it was eaten without hesitation and with apparent satisfaction.

When the gopher was being fed it would usually take the food from my fingers with its paw; then, if a larger piece, it would seize it with its teeth, and, turning quickly about and crawling into its nest, would tuck it vigorously into and under the nest material in its storage corner. Thereupon it immediately returned for more. After four or five such trips it settled down in its nest, pushed its head under the nest material,

and began eating in this position. When smaller pieces were given it the gopher quickly passed them into its pouches and carried them into the nest in that manner. On one occasion when I handed it a slender flexible rootlet of sweet clover about six inches long, it deftly passed the entire rootlet, a part at a time, into one of its pouches, so that the coils were easily traceable on the outside of the pouch.

On the morning of April 29 I discovered a young one in the nest. How many there may have been in the first place I do not know. I am inclined to believe from the appearance of the female at the time of its capture that there had been no more. When I first saw the young one I estimated it to be a few days, perhaps a week, old. I had heard faint squeaks off and on for a few days when I came to feed the mother, but I had made no attempt to investigate for fear of exciting her. The eyes of the young one were still closed. Its body was covered with a short coat of pale grayish hair above, with a very scant growth on the underparts. I estimated its total length to be about two inches or perhaps a little longer.

On the afternoon of the next day I very cautiously peered into the nest and saw the mother gopher lying partly on her back and partly on her right side, with all four feet spread widely apart. Her head was thrown slightly to the left, exposing both pouches to view. The animal was asleep, with the body wholly relaxed. The young one was nursing at an inguinal nipple. It all reminded me of a comfortable, motherly old house cat nursing her only kitten.

During the two following days I made frequent visits to the cage in an endeavor to learn something of the home life of the pocket gopher and her young, so far as I might do so without unduly exciting or disturbing the mother. The young one occasionally uttered faint squeaks, as before suggested, like those of a young mouse. At times when the mother was storing away food her offspring was subjected to rather rough treatment. The food was stored at the opposite corner of the nest from that in which the young lay, and when, therefore, the mother was engaged in her practice of pushing her food into the nest material the young one would be knocked sprawling and partly buried in debris by the vigorous thrusts of her hind feet. It would lie squeaking and twisting, trying to right itself, but the mother paid not the least attention.

On one or two occasions when the young one was suckling and the mother quickly roused herself and came out of the nest, it clung to the nipple and was dragged up onto the edge of the nest. Then it rolled back, and after much squirming, twisting, and kicking succeeded in

righting itself. Its resting posture was then the same as that of the adult.

But my period for observations on this interesting family was destined to be brief. Whether my frequent visits of the last two days were responsible, whether the fault lay with the food, with the unnatural surroundings in general, or with a combination of all of these, I cannot say, but in the afternoon of May 2, when I returned after an absence of a couple of hours, I discovered that all was not well in the cage. The nest material had been disarranged and more or less scattered about. The gopher appeared excited, and was quite savage when I attempted to push aside some of the nest material to look for the young one. The little one was missing. I made a systematic search throughout nest and cage, but no trace of the young one was to be found. As the character and location of the cage were such as to preclude any possibility of tampering from without, there was but one conclusion to be drawn: The pocket gopher had turned cannibal.

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PAST AND PRESENT BIG-GAME CONDITIONS IN BRITISH COLUMBIA AND THE PREDATORY MAMMAL QUESTION

By Allan Brooks

Three papers on predatory mammals in this Journal (Vol. 6., nos. 1 and 2) impel me to a small contribution to this subject, as, to a practical conservationist, it appears that several vital points in the question have been entirely overlooked.

The papers by Dr. Charles C. Adams and Dr. Lee R. Dice, both pleas for the conservation of predators, are chiefly based on sentiment and theories. One of these theories is the oft-repeated one that a certain number of predatory mammals are a benefit as they tend to improve the general health of the mammals they prey on by killing off the weaklings and diseased individuals. This theory is disposed of in toto by the results of the introduction of game mammals into New Zealand. The introduced red deer can be taken as an example; from a very meagre beginning, some two or three individuals in each case, the country has been stocked with animals that have far exceeded in size and stamina the animals of the country from which they were introduced. There

have been no predatory mammals to exert the beneficial influence supposed to bring about this condition. As a matter of fact predatory mammals of all sorts do most of their killing on females heavy with young and animals under one year old, especially the new born and comparatively helpless young. In the latter instance no trace is left as a rule, and so the killing is unnoticed in parks.

Major Goldman's résumé of the conditions is a most excellent one, dealing as it does with facts and not theories, and is based on a vast amount of actual work. But he does not go far enough in his conclusions.

All writers nowadays seem to base their contentions on the thesis that the whole of the North American Continent was well if not densely populated with many species of ruminant big game before the advent of the white man. Reading some of the narratives of the earliest explorers does not bear out this theory. Quotations could be made from some of these relating to the eastern portion of the continent to prove that game was, even then, in some regions extremely scarce, but I will restrict myself to conditions existing in the Province of British Columbia. The narrative of one of the earliest pioneers, Alexander McKenzie, who traversed the Province from the Peace River southwest to the coast in 1793 is illuminating in this regard. During all their long journey and subsequent return only one head of horned game was reported by one of the party, a single individual of the "Red deer of the plains." McKenzie's comment on this scarcity was that in years when the salmon run was a poor one the Indians starved to death in great numbers. At the beginning of this present century the eastern portion of this same region comprising the Omineca and Cariboo districts was a poor one for big game except bear. Caribou had been fairly plentiful but had been badly thinned, moose were almost unknown, and mule deer were just commencing to come in from the south.

Compare these conditions about one hundred years apart with the game conditions in the same region at the present day. Moose have come in from the northeast and increased tremendously both in numbers and range. Caribou are holding their own, and mule deer have increased ten-fold. The undoubted causes of this increase are the decrease of the aboriginal tribes and the destruction of bears and wolves. In 1901 I heard of many trappers both white and Indian who had snared as many as forty black bears in a season. In this connection it may be noted that the bear was venerated throughout the entire region by all the resident Indian tribes; even if killed his flesh was not used for food

in the old days. Whatever the habits of the black bear are in the east, in the west he is an inveterate killer of very young fawns of all the deer tribe.

Conditions in the whole southern interior of British Columbia at the time of the white man's advent were not much better than in the Cariboo and Omineca districts. Elk were exterminated there before the advent of the white man except in the extreme southeastern corner; mule deer were practically unknown, and it was not until the early '80s that these became plentiful, bringing with them that scourge of the deer-tribe the cougar. Moose were unknown except in the Flathead region of the extreme southeast. Only caribou, sheep, and goats were more plentiful than at the present day, and also probably the Columbian white-tail (*Odocoileus leucurus*), confined to the valleys in the extreme south.

At the present day elk in the southeast are holding their own if not distinctly on the increase, moose and the western white-tail (*Odocoileus a. macrourus*) are greatly increasing their range, and caribou, sheep, and goats still exist in some numbers at nearly every point of their former range.

At several periods since their first invasion mule deer have been reduced to a very low ebb induced by four causes: parasitic diseases, predatory mammals, winters of exceptional conditions, and promiscuous killing by Indians. For the last twenty years these deer have been more than holding their own, chiefly owing to a mitigation of causes two and four. We can now definitely trust to a perpetuity of a fair stock of mule deer for all time, providing only that the present laws are enforced and a war against cougars and coyotes is kept up.

Predatory mammals can by themselves completely denude a large district of deer. Several instances of this have come under my notice. About twenty-five years ago I hunted in a remote region west of the Cascade Range that had been within two years well stocked with black-tail deer without jumping a single animal and hardly seeing a track; little or no hunting by man had been done there. Cougar sign was plentiful and their excreta showed that they were reduced to a diet of the rodent *Aplodontia*. The following year the cougars had left this district to depopulate some other in a similar fashion. Several unsettled districts on the northern portion of Vancouver Island, where deer are usually more than abundant, have at different times in recent years been depopulated by cougars with the probable aid of wolves, and the deer almost completely exterminated. In the course of time, the

predators having left the district, it becomes once more populated by deer to be followed by a steady increase of their predators. And so the cycles of scarcity and abundance ensue.

To summarize the present big game conditions in British Columbia: ruminant big game is probably five times as abundant at the present day as it was when Alexander McKenzie first traversed the region towards the close of the eighteenth century, and, with the possible exception of caribou and the Columbian white-tail (*leucurus*), it will continue to hold its own, and in the case of some species to increase, providing sane methods of protection continue to be enforced.

In the eastern portions of the continent we need not yet talk of the "close of the age of mammals" when states like Pennsylvania can show a record of 7000 buck deer killed in one year, where Frank Forester over fifty years ago deplored the utter absence of deer and predicted their complete extermination within twenty-five years. Over large areas of the eastern states the demands of agriculture have evicted the deer, which have colonized a still larger area to the north where they were unknown in earlier times. In other areas, as in northern New England, the once cleared country is reverting to forest and miles of deserted farms will compensate for the intensive cultivation of more favored areas. Any pessimist who talks of the extinction of our big game must be either ignorant of or wilfully blind to the present day conditions.

And finally there is little danger of any present-existing species of large predatory mammal of North America being exterminated while Canada affords such an immense area of absolute wilderness. Let those who wish to study these follow them there and not insist on their perpetuation in accessible areas with the concomitant destruction of useful horned game and stock. The garbage-can grizzlies of our parks can have little value in the study of the life-history of the animal.

Okanagan Landing, British Columbia.

HOW BEAVERS BUILD THEIR HOUSES

By Vernon Bailey

[*Plates 5–9*]

Beaver intelligence is neither human nor superhuman, as some would have us believe, but for the beavers' needs it meets, far better than human intelligence could do, every emergency of beaver life except one. The one exception is the man-made trap which swept these wise and useful animals to the verge of extinction before man began to realize the foolish waste of his greedy methods. Ages ago the beavers learned to cope with their natural enemies, to out-swim, out-dive, out-build most of them, and so to live safe and comfortable lives. As builders of houses, dams, reservoirs, and canals, they have become famous and have won admiration and respect.

Their houses are not only homes, but fortifications, affording convenient, comfortable, and sanitary living quarters, and safe retreats from most of their enemies. A well made and long-established beaver house, with thick walls of tangled logs, sticks, roots, sod, and mud would baffle any animal less powerful than a bear, armed with strong claws and teeth, or man, armed with cutting tools. Even the bear and the man would be so long delayed in forcing an entrance that the occupants of the house would be far out of danger's way, and safely hidden in some other house or secure bank burrow.

Before a beaver house is begun a satisfactory location must be selected. Sometimes it is far from shore, out in water five or six feet deep, sometimes on the bank of a lake or stream, and often on a floating marsh just back from the edge of deep water, but always where a doorway from the bottom of the house leads down into water deep enough to remain open all winter under the ice. Out in the lake this is simple enough, and the doorway may open out in any direction; on the bank a long tunnel or subway must be dug from deep water up under the house to serve as an entrance and exit; on a floating marsh the beavers must swim under the sod and cut a hole up through to the surface, later building their house around and over it, perhaps the simplest and safest method of all.

Most new beaver houses are begun where a feeding spot has been in use for a year or more, and such places are always numerous in a populous beaver colony. The water-hole, or entrance, is the first step, then at its edges the peeled sticks left from many meals of bark are pushed

back from the water's edge, or left to sink in the open lake to form an island. A long and peaceful possession of a feeding ground and a convenient food supply are important factors in the location of a new house, but sometimes the necessity of a mother beaver to provide a place for a new family, or of a father beaver to move elsewhere to make room for his newly arrived children, or some accident to the previously occupied residence, act as building incentives at any season of open water. Old peeled sticks are brought and laid around the water-door, new bushes are cut and added to the circle, even trees are felled and the limbs and sections of small trunks brought and laid on the walls until they are two or three feet high, then more sticks are laid over the narrowing top, and last of all, often not until cold weather begins, mud and sods are brought up in great armfuls from under water and piled over the sides and on top of the house. Each year more sticks and more mud are piled on, and the older and larger the house, the more settled and tangled and thicker its walls become, and the safer is the household within. Sometimes a new house will be so thin-walled that the nest within may be seen through the chinks at the top, for the top is the last closed and always the least solid part.

But to return to the inside of the beaver house; instead of numerous rooms and elaborate apartments as once supposed, the inside consists of one room, generally two or three feet high, and three, four, or five feet wide, circular, oblong, or any shape or size, according as one beaver, a pair of beavers, a family, or sometimes two or more families, occupy it. If more room is needed the walls are hollowed out, the sticks cut off, and the earth dug back to make room in any desired direction, the massive walls, often two or three feet thick, allowing for any inside changes found necessary. Nine beavers, five young and four old, is the largest number I have ever found inhabiting one house, but others have reported larger families in very large houses. As the beavers all live in one room, it must be large enough to give sufficient air without becoming too warm, as it would if too small and crowded. More room, more ventilation, and lower temperature can always be obtained by making the walls thinner from within, and the beavers, with heavy fur coats to keep them warm in ice water, need cool houses. Even in solid old houses there is always some ventilation, and steam may sometimes be seen curling up from the peak on frosty mornings or frost crystals filling the cracks in the snow that covers the house in winter.

The beds are simply the floor of the house, a few inches above the water-level, usually strewn with bits of bark, grass, or roots left from the

food, and are always damp but clean and well drained, generally somewhat musky with the not unpleasant odor of the musk glands. Fresh food is constantly being brought in and eaten, and the peeled sticks and refuse carried out. If the water rises the floor is built up, and if it falls the floor may be lowered to keep the beds near the water door. With newly born young in the house there is a softer bed of grass, leaves, twigs, and rootlets that serve also as food when the young are old enough to begin eating, probably long before they take the deep dive and long swim out to the world of light.

The large water-door, usually but one, opens at one end or side of the floor, straight down into the water below the walls of the house, then leads out to the open lake, pond, or stream, often a distance of ten or twenty, and sometimes forty feet before the beavers can come to the surface. Upon leaving the house the beavers rarely come to the surface nearby, and often swim out ten or twenty rods under water before coming to the surface to look around, or, if frightened, they may go half a mile or more under water and then come up under cover of the bank or shore vegetation, or enter another house or bank burrow. In returning to the house, if unafraid, they often swim up to within four or five rods and then go under water the rest of the way. Often by lying quietly near the house one can hear them go gurgling out through the water-hole, then hear them come bubbling up into the nest chamber again and, if they have brought in food, hear the big chisel teeth scrape, scrape, scrape, as the bark is peeled off and eaten. When young are in the house their whimpering cries can often be heard from outside.

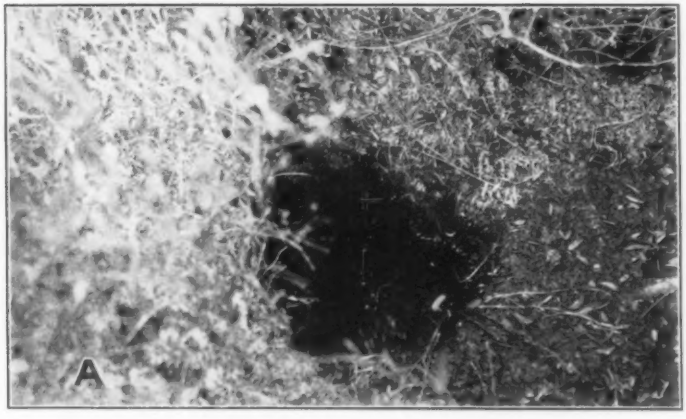
Most of the building and other work of the beavers is done at night so that only by long and patient waiting can one see even a small part of it being done, and the camera, even by flashlight, records but little of their nocturnal industry. Sometimes late in the evening or in the early morning twilight they may be seen cutting and dragging or towing trunks and branches for building material, and with their strong teeth dragging them up on the sides of the house and placing them as desired, or coming up from deep water with fore legs full of dripping mud, sticks, and leaves from the bottom, then rising to an almost erect position on the strong hind feet as they march up the steep slopes, steadied by the broad tails, to deposit their loads on the sides or tops of the houses.

Still more rarely does one get a glimpse of the interior structure of the beaver house, except in its early stages when, from a mere bed in the sphagnum moss, under the grass and low shrubs beside the water-door, can it be watched until securely roofed over. On one occasion I hap-

pened to be close by when an old beaver on the inside stuffed and plastered up with mud and sticks a hole that had been dug by a mink through the walls of the house. The sticks were pushed into the hole and then mud pushed in around them until light, air, and troublesome neighbors were excluded.

All of the building must be done before the water freezes over and the houses are buried in snow, and the beavers shut in for the winter. With frozen walls there is little danger from outside enemies. The bears are asleep in their own winter dens and trappers are prohibited by laws from cutting into or disturbing beaver houses, even where beaver trapping is allowed. Where trapping is not allowed winter is the season of safety and comfort for the beaver folk, for the water under the ice can not get colder than the freezing point, the room in the beaver house is kept warm by the heat of the animals' bodies, and the food supply is convenient and generally ample. Just how this life is carried on will not be fully known until some of the beavers are tamed so that it will be possible to enter their houses through a "back door" without disturbing them, or get them to live in houses which we may build with modern improvements to suit their taste and our convenience. This will be necessary before beavers can be successfully raised in captivity, as the success of this branch of the fur industry will depend on a full knowledge of the habits, dispositions, and requirements of the animals.

U. S. Biological Survey, Washington, D. C.



THE BEGINNING OF A BEAVER HOUSE

The first step toward a beaver house is the water-door, a big hole through which a beaver can plunge to safety, even from a mere summer bed in the sphagnum moss, sheltered by low bushes or tall grass.

THE SECOND STEP

The next step is an accumulation of peeled sticks from which the bark has been eaten. As these are pushed back from the nest the walls of the house are slowly formed and can be quickly completed when a new house is needed. A small beaver house will seem to spring up in a single night, but always on an old foundation and around a satisfactory water-hole.

A Young Beaver House

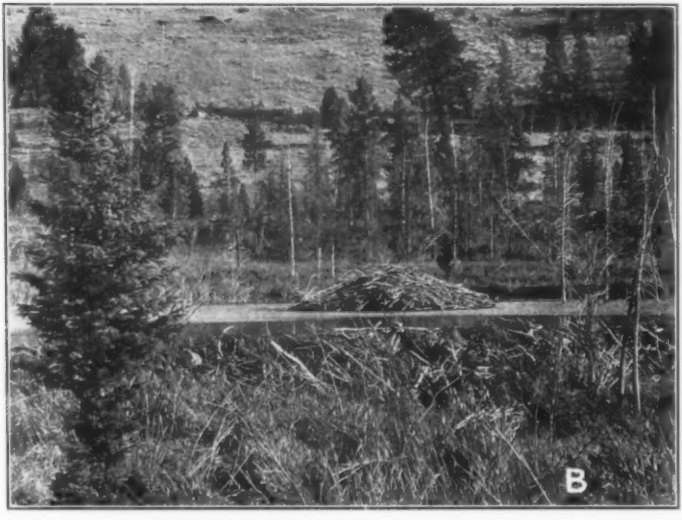
A new or recently built beaver house always has steep sides and is generally as high as it is wide. If located out in a pond or lake there is often as much or more of the house material under water as there is above.

A Well Built Beaver House

This house in the middle of a pond was being built up and thickened for winter use. Mud and sticks were piled on the sides and top every night, and green wood cached in the water near the house for winter food. Early mornings and late evenings the beavers were often seen at work on it.

A Little-used Beaver House

An old beaver house, not used since the previous year, is always low and wide, with mud washed out of the surface layer of sticks by many rains, and the walls well settled into the water. When used again it will soon be built up with a high and rounded top.



A Typical Beaver Colony in the Mountains

A well-kept beaver dam, pond, and house on one of the small streams in Yellowstone Park. Photographed by M. P. Skinner.

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AN ADIRONDACK BEAVER HOUSE

A large and rather new house in summer, before receiving its coat of mud. Estimated about 8 feet high and 35 feet wide at base.

A WISCONSIN BEAVER HOUSE

A recently occupied house where the dam had been blown out and the water drained off, showing the foundation and an opening made into the nest chamber, which was large enough for a person to move about inside.

UNIV. OF ILLINOIS

A Minnesota Beaver House

A large and well-built beaver house on the edge of one of Minnesota's numerous lakes.

A Very Large Wisconsin Beaver House

This beaver house was said to be 14 feet high and 40 feet wide. Photographed by W. T. Gray.

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OF
MICH

THE MONTANA NATIONAL BISON RANGE

By Morton J. Elrod

[*Plate 10*]

On May 17, 1925, I made a visit to the National Bison Range, about forty miles northwest of Missoula, Montana. A statement of conditions of the range will doubtless be of interest to all who are interested in the preservation of the American buffalo.

The range, which is administered by the U. S. Biological Survey, includes some nineteen thousand acres, selected and set apart by act of congress in 1909, following a campaign by the American Bison Society for funds to save the animals from possible extinction. The range is made up of open hillsides, open pine woods, open grassy ravines, creek bottom, and a half-mile of the Jocko River. The center embraces a grass-covered mountain rising two thousand feet above the river, with ridges extending in several directions. The general contour is such that there is good water at all times, and protection from wind and drift in some places, no matter what the conditions.

When the range was established some thirty-seven head of the animals were placed on it. The original estimate was that they would double in number every three years, and that the range would hold about one animal for each fifteen acres. This estimate now appears to have been a little high. The present warden, Frank H. Rose, thinks it will accommodate about 875 bison and give food throughout the year. The herd has doubled, approximately, each three years.

When Mr. Rose arrived to take care of the herd two years ago it numbered over seven hundred. Meanwhile elk, antelope, white-tail deer, black-tail or mule deer, and mountain sheep had been added. Between twelve hundred and thirteen hundred head were on the range, which had become closely grazed, too closely for all of the animals to thrive without being fed.

When the range was selected it was anticipated that conditions might be such that feeding would be resorted to during a portion of some seasons. Along the north side of the range, that is, along Mission Creek, it was thought the land would be suitable for raising hay. But the employment of men on an eight-hour day, as is the government plan, makes hay growing too expensive, practically prohibitive, so far from shelter or working center. It is cheaper to buy, but for the purchase of hay there was no appropriation. The size of the herds made it neces-

sary to use drastic measures to bring the range back to a condition where it would supply sufficient forage, and the herds to a size where the forage would keep them throughout the year. The experience of the past years had shown conclusively that continued increase in numbers would quickly reduce the range to a condition where the animals would starve.

To remedy the situation forty-four bison were disposed of alive, two-hundred and twenty were sold for food, and the herd was thus materially reduced in number. At the time of my visit there were four-hundred and ninety bison, of which four hundred and sixty-one were in pens, the remainder on the open range. There were thirty-five or forty calves.

Notwithstanding the fact that the range was established for the protection and preservation of the bison, nevertheless, somehow during the intervening years elk and deer were introduced, and had multiplied until they numbered over six hundred, about as many as the bison. The elk numbered five hundred and the deer over one hundred. The range was overstocked and being depleted. Some of the animals had to be removed.

Although there is no danger of present extermination of the elk, and tens of thousands still roam in Montana, yet there was very strong local and other public sentiment against killing any elk in the range. I regret to say it but it is a fact that buffalo were killed and elk permitted to live in order to reduce the number of animals on the range. This method was in opposition to the judgment of Biological Survey officials, and was, as reported by Mr. Rose, solely in response to public sentiment. But since the range was made for the bison they are to have it, and the elk must go, except in so far as the range will be able to support both buffalo and elk. Mr. Rose says this is the decision. Only useless buffalo will be killed. All breeding animals will be saved.

The reason so many were killed was because they could not be given away. Park organizations did not have funds for transfer of the animals from the range. Hence they were sold for food.

At the present time over five hundred elk are in the range. As they do not drive they are not to be penned as easily as bison, and therefore have their freedom. There were formerly sixty antelope on the range, but all were killed by coyotes. Not one was left. War on the coyote has been relentless, and it is now believed they are held in check. Meanwhile a nucleus of eight young antelope has been received from the wardens in the Nevada desert, and Mr. Rose thinks be can build up a new herd. It is just about as important to save them as bison.

GENERAL VIEW OF PENS AND PONDS FOR WATERING PLACES IN THE NATIONAL BISON RANGE

The separating pens and hay piles are at the left foreground. The grassy slopes of the hills are well represented. Note the absence of trees on this part of the range. The view is nearly east.

NATIONAL BISON RANGE

Cows and calves in the foreground; males in the distance, appearing only as black specks. Snow-covered Mission Mountains in extreme distance. The calves were lying down; on near approach each calf rose and passed behind its mother, or the mother stepped between the calf and the intruder. The calves have the general color of a young Jersey cow. View southeast.

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The start of the Rocky Mountain sheep was four males and eight females. There are now twenty-eight. The high hills and steep rock slides afford natural home conditions, and they seem to be thriving. Thus the range is affording a range and haven for three important American mammals, the bison, the antelope, and the mountain sheep, each of which is threatened with extinction.

During the winter of 1923–1924 large pens were constructed for the bison and in the spring of 1924 they were driven in. The plan was to feed hay until July 1, and permit the range to recover. The native grasses grow in bunches, which had become fewer in number due to close cropping. The small bunches pull up by the roots in dry weather when the range is closely grazed. Only a little seed had developed, and a new stand of grasses was not possible. It was necessary to permit the grasses to grow long enough to seed well before the animals were turned loose again. The range looked well at the time of my visit, during the second year supplemental feeding has been resorted to, and it has recovered wonderfully. An early spring with plenty of rain has greatly accelerated the growth. So great has been the come-back that it will probably not be necessary to pen the animals long next season, although this will probably be necessary in the early spring when the grass is starting and the range is soft.

The pens are really good-sized farms. The posts are large and high, the lumber about two by twelve inches by twelve feet. The gates are heavy, and held by heavy hinges and chains. By a special system of gates in the sides of a chute animals could be directed into either one of two gates. Thus the males were directed to one enclosure, the females to another. At the time of my visit three pens were used, one always being idle. Into the unused pen hay was hauled and distributed. The cows and calves were permitted to enter when all was ready, and the gate then closed. Hay was then distributed in the pen which the cows had vacated, and the males were allowed to change enclosures. The pen from which the males had moved was treated in the same manner.

Fresh, clear, and running water was in each pen, from which the animals drank freely. The water came from springs in the ravine in the mountain side. Borings assisted the flow, which was directed by iron piping, and developed into small ponds by dams, a pond for each pen.

With the reduction in the number of bison and a similar or greater reduction in the number of elk, and with a rest for the range until July 1, it seems certain the forage will be ample for food for the remaining animals during the summer, fall, and winter, and in addition supply an

abundance of seed. The season in Montana has been nearly a month early, there has been abundance of rain and warm weather, and vegetation has had better growth than for many years past and there could be no better season for improving the range.

Mr. Rose has used good judgment and has developed some excellent planning in all this treatment of the bison and the range, and has been aided greatly by the favorable season.

The accompanying illustrations, taken at the time of my visit, will give a better idea than words of the surroundings and general conditions, and the method of penning the animals. The day was hazy, and the beautiful Mission Mountains forming the background for the view are barely discernible.

State University, Missoula, Montana.

RETENTION OF CERCOPITHECUS, TYPE DIANA, FOR THE GUENONS

By C. W. Stiles and Mabelle B. Orleman

In classifying zooparasitic infections of the Primates it has been necessary for us to attempt to arrange the hosts according to their modern classification. This has made it necessary for us to examine certain extensive catalogues (example, Trouessart, 1897c; Palmer, 1904a), and monographs (example, Elliot, 1913), as well as text books (example, Leunis, 1883a), and general discussions (example, Flower and Lydekker, 1891a; Lydekker, 1911), with the result that we have become acquainted first hand with some of the confusion in the nomenclature of the Primates from Linnaeus, 1758, to the present day.

Two points in particular are outstanding as basis for existing confusion in the literature, namely,

(1) A number of authors have omitted from their writings the very important principle of genotypes which was so clearly indicated by Linnaeus in his Rules of Nomenclature, as follows:

> 242.—Nomen genericum antiquum antiquo generi convenit.
>
> 246.—Si genus receptum, secundum jus naturae & artis, in plura dirimi debet, tum nomen antea commune manebit vulgatissimae & officinali plantae.

(2) Several authors, even of recent date (Trouessart, 1897; Elliot, 1913), have apparently considered that subgenera are nomenclatorially

on a basis quite distinct from genera in spite of the following unambiguous provisions of the International Rules:

> Article 6.—Generic and subgeneric names are subject to the same rules and recommendations, and from a nomenclatural standpoint they are coördinate, that is, they are of the same value.
>
> Article 7.—A generic name becomes a subgeneric name, when the genus so named becomes a subgenus, and *vice versa*.
>
> Article 9.—If a genus is divided into subgenera, the name of the typical subgenus must be the same as the name of the genus.

For instance, both Trouessart and Elliot use *Macacus* in a subgeneric sense for a group which does not contain the type species of *Macacus*.

In endeavoring to classify the diseases with which we have been dealing, the nomenclatorial disagreements in respect to *Cercopithecus* have naturally come to our attention. As the points at issue are purely questions of formal nomenclature and not of zoological classification based on anatomical characters, we feel justified in discussing the case since our interpretation is quite different from that of other authors and despite the fact that the group in question does not lie in our specialty.

Briefly stated, for about a century and a half, the generic name *Cercopithecus* was employed in literature for a group of African monkeys known by the vernacular name "Guenon." Suddenly Elliott (1911, pages 341–342) transferred it to a group of American monkeys and designated *Simia midas* Linnaeus as type. This resulted in bringing the case before the International Commission with the request by prominent mammalogists that the International Rules be suspended to allow the retention of the name *Cercopithecus* for the African group typified by *Simia mona*. The case was studied for the Commission by Commissioner Allen who reported in favor of suspension, and his recommendation (see Opinion 90, International Commission of Zoological Nomenclature) received sixteen affirmative against two negative votes. Under existing circumstances (since the vote was not unanimous) this case becomes tabled as respects suspension until the next meeting of the International Zoological Congress when, according to the Rules, it will be referred to a special committee of three for a final decision.

Since the vote in Commission was taken, the authors of the present paper have found it necessary in connection with their own work to take a definite position in regard to the case *Cercopithecus* versus *Lasiopyga* pending the final disposition of the case, and this necessity has led them to examine the original documents which, in their opinion, make it possible without suspension of Rules to retain *Cercopithecus* in its almost

universally used sense and thus to relieve the situation which has arisen. The essential nomenclatorial data are as follows:

1758: *Cercopitheci* Linn., 1758a, 26, as subgroup of *Simia*, to contain the long-tailed monkeys, 17 species: 5 *silenus*, 6 *faunus*, 7 *paniscus*, 8 *diana*, 9 *cephus*, 10 *aygula*, 11 *hamadryas*, 12 *iacchus*, 13 *oedipus*, 14 *aethiops*, 15 *midas*, 16 *cynamolgos*, 17 *apella*, 18 *morta*, 19 *capucina*, 20 *sciurea*, and 21 *syrichta*. Genotype apparently undetermined, but Thomas (1911, 127–129) retains 8 *diana*, 9 *cephus*, and 14 *aethiops* as *Cercopithecus*. Some authors do not recognize the subgeneric groups for which Linné used names in the plural; other authors recognize them as subgenera.

1762: *Cercopithecus* Brisson, 1762, 133. Stirps 4 (rostro brevi) of genus *Simia:* contains 29 species, with references to several species of Linn., 1748a, 6th ed., but with no quotation of Linn., 1758a. Accordingly, nomenclatorially *Cercopithecus* Brisson, 1762, is independent of *Cercopitheci* Linn., 1758a. It can be construed as a dead homonym.

1763: *Cercopithecus* Gronovius, 1763, 5. This is not a proposition of a new generic name but adoption of *Cercopithecus* Brisson, 1762, in generic form with discussion of two American species (*midas* and *morta*), both mentioned by Linn., 1758a; Gronovius quotes Linn., 1758a, in connection with both species, and he quotes Brisson in connection only with *morta*. Elliot (1911, 341; 1913, vol. 1, 190) accepts *Cercopithecus* from Gronovius, with *midas* as type. Thomas, 1911, 128, places *midas* in *Leontopithecus*, and considers *morta* undeterminable. Opinion 89, International Commission Zoological Nomenclature, suspends Gronovius, 1763, from a standpoint of nomenclature; accordingly, the type designation by Elliot does not settle the case for *Cercopitheci* Linn.

1772: *Cercopithecus* Brünnich, 1772, 34. Based on the "Marekatten," fide Palmer, 1904a, 171; type *mona*, designated by Sclater, 1900, fide, Palmer, 1904a, 172.

1773: *Cercopithecus* L. of Müller 1773, 119. "Langgeschwanzte, Affen (*Cercopithecus*) oder Meerkatzen;" 27 species (of which 16 bear Linnaean names of 1758a).

1777: *Cercopithecus* of Erxl., 1777; 22 species.—Type *Simia mona*, fide Sclater, 1900, 5–11, Palmer, 1904a, 172, and Elliot, 1913, vol. 1, xxxii. "*Cercopithecus* Erxl., 1778, type *nictitans* L., 1758," fide Apstein, 1915a, 199.

1779: *Cercopithecus* of Blumenbach, 1779, 68. Confined to "Meerkatze;" contains 2 species, *C. paniscus*, *C. jacchus*; "Das ganze Geschlecht ist blos in America einheimisch." No type designated.

1799: *Cercopithecus* of Lacépède, 1799, Tableau, 4. Guenon. Cites only *C. nasica* [as example, not as type designation; not an original, 1758, species].

It is to be noticed that Elliot based his nomenclatorial interpretation, selecting *Simia midas* as type, on premise that Gronovius, 1763, is the first author who comes into consideration and that the original publica-

tion of 1763 mentioned only two species, namely, *Simia midas* and *Simia morta*. As stated above, Opinion 89, International Commission, suspends the Rules for Gronovius, 1763, in all cases where the law of priority is involved. Accordingly, it is unnecessary to consider this paper further and the type determination of *midas* by Elliot, 1911, automatically lapses.

It is to be noted that Linnaeus, 1758, divided *Simia* into three subgroups to which he gave names in the plural instead of the singular, namely, *Simiae*, species 1 and 2; *Papiones*, species 3 and 4; and *Cercopitheci*, species 5 to 21. Müller, 1773, page 123, cites *Cercopithecus* in the singular in referring to Linnaeus' groups. The question arises as to the status of these subgroups of *Simia*. Palmer, 1904a, page 29, rejects plural subgeneric names. Jordan and Evermann, 1917a, page 14, on the other hand, accept these names from Linnaeus. Cf. *Truttae* Linn., 1758a, 308; *Osmeri*, page 310; *Characini*, page 311.

The interesting point develops that while Linnaeus, 1758a, used the foregoing subgeneric names of mammals and fishes only in the plural form, when it came to the *Hemiptera*, pages 434–439, he used the plural form in the text but he printed the name in the singular as page heading and he followed this same plan also in *Cimex*, pages 441–451, and *Papilio*, pages 458–488, not in the case of *Sphinx*, pages 489–495, but again in the case of *Phalaena*, pages 495–542. As a matter of comparison it may be recalled that the mammalian genus *Gazella* appears first to have been published in the plural, as *Gazellae* Lichtenstein, 1814, 152, 171.

Our interpretation of Linn., 1758a, is that these subgeneric groups are subgenera in the modern sense, that there is no escape from accepting the subgeneric names given under *Gryllus*, *Cicada*, *Cimex*, *Papilio*, and *Phalaena*, and we see no reason for rejecting the subgeneric names given under *Simia*. Many authors cite generic names in the plural when not given in combination with the specific names but in the singular when given in binomial combination. Subgeneric names are frequently not cited in binomial combination and it seems not at all strange to find them cited in the plural as well as in the singular when given alone.

With the foregoing interpretation of *Cercopithecus* as dating from Linnaeus, 1758a, page 26, it is legitimate to interpret *Cercopithecus* of Brisson, 1762, page 133, as nomenclatorially independent of Linn., 1758a, and as a dead homonym which is not to be taken into further consideration.

Aside from the type designation *Simia midas* by Elliot, 1911, the only

type designations for *Cercopithecus* which we have been able to find are *mona*, designated by Sclater, 1900 and "*nictitans* L. 1758" by Apstein, 1915a; but neither *mona* 1774 nor *nictitans* 1766 [not 1758 as quoted] is an originally included (1758) species of *Cercopithecus*, and, therefore, these type designations do not stand.

From our viewpoint the genotype of *Cercopithecus* 1758 has never been validly designated and in order to unravel the present confusion we hereby designate *Simia diana* Linn., 1758a, page 26. as genotype.

This same species (*diana*) is the genotype by absolute tautonomy of *Diana* Lesson, 1840, which is preoccupied by *Diana* Risso, 1826, Pisces. In order to clear the decks, so to speak, we hereby designate *diana* as type for *Monichus* Oken, 1816, 1208, *Diademia* Reichenb., 1862, 107, and *Pogonocebus* Trouess., 1904, 14, thus making these objective synonyms of *Cercopithecus*.

The foregoing interpretation establishes *Cercopithecus* in its usually accepted sense instead of the sense given to it by Elliot, 1913, who uses *Lasiopyga*, type *Simia nictitans* Linnaeus, as generic name for the guenons. The name *Lasiopyga* becomes a subjective synonym of the generic name *Cercopithecus* and it automatically supplants the subgeneric name *Melanocebus* Elliot, 1913, vol. 1, lix; vol. 2, 302, type *leucampyx*, fide Lydekker, 1915.

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A NEW SUBSPECIES OF THE CALIFORNIA SPOTTED SKUNK (SPILOGALE PHENAX MERRIAM)[1]

BY E. RAYMOND HALL

While comparing certain Mustelid material obtained from Pleistocene cave deposits in California with Recent material contained in the Museum of Vertebrate Zoology, several striking differences were noted between specimens of Recent *Spilogale phenax* from southern California and those from the middle and northern parts of the state. The southern race may be known as

Spilogale phenax microrhina new subspecies

Type.—Male, adult, skull and skin; no. 3215, Mus. Vert. Zool., Univ. California; Julian, San Diego County, California; July 29, 1908; collected by Frank Stephens; original no. 1308.

Diagnosis.—A *Spilogale* of the species *phenax*. Body short, hind feet medium, tail long, ratio of tail length to body length averages 64.5, nose small, skull triangular, braincase flattened.

Distribution.—Lower Sonoran, Upper Sonoran, and Transition zones of San Diego, Orange, Los Angeles, Ventura, and the eastern parts of Riverside and San Bernardino counties, California.

Specimens examined.—Total number 43, from following localities in California: San Diego County: Julian, 16; Escondido, 4; Cuyamaca Mountains, 3. Riverside County: Santa Rosa Mountains, 1; Jurupa Mountains, 1; Cabezon, 2; Kenworthy, 1. San Bernardino County: Colton, 2. Orange County: Trabuco Cañon, 3.

[1] Contribution from the Museum of Vertebrate Zoology of the University of California.

Los Angeles County: Pasadena, 5; Sierra Madre, 1. Ventura County: Ventura, 3; Matilija, 1.

Measurements.—See table 1; comparisons should be made with the measurements given by Howell (North Amer. Fauna, no. 26, pp. 31–32, 37) which also show the decided decrease in body length and increase in tail length from north to south.

TABLE 1

	TOTAL LENGTH	TAIL VERTEBRAE	HIND FOOT	CONDYLOBASAL LENGTH	OCCIPITO-NASAL LENGTH	WIDTH OF OPENING OF EXTERNAL NARES	WIDTH OF ROSTRUM (MEASURED ACROSS CANINES)	GREATEST ZYGOMATIC BREADTH	GREATEST MASTOID BREADTH	LEAST INTERORBITAL BREADTH	PALATAL LENGTH	POSTPALATAL LENGTH	HEIGHT OF CRANIUM (EXCLUSIVE OF SAGITTAL CREST)	LENGTH OF TOOTH ROW (ANT. BORD. OF C TO POST. BORD. M^1)
S. p. microrhina														
Type	405	157	47	57.0	51.4	6.2	13.3	35.7	32.8	15.0	22.2	30.0	17.0	20.0
(Average) type and 7 topotypes	426	167	47	56.5	51.7	6.2	13.3	35.8	32.6	15.2	22.1	29.7	16.7	19.0
Ratio				100.0	91.3	11.0	23.5	63.5	57.7	26.9	39.1	52.6	29.6	33.6
Maximum	447	182	50	59.9	55.0	6.4	14.0	37.8	33.7	16.0	23.3	31.5	17.6	20.0
Minimum	405	154	45	54.0	48.7	5.6	12.5	34.0	31.4	14.3	21.3	28.5	15.4	18.0
S. p. phenax														
(Average) 5 topotypes	455	153	49	59.2	54.6	6.8	14.2	38.8	33.9	16.6	23.4	31.0	17.7	19.4
Ratio				100.0	92.2	11.5	24.0	65.5	57.3	28.0	39.5	52.4	29.9	32.8
Maximum	473	165	53	62.2	57.0	7.4	15.4	40.5	35.5	17.5	24.5	33.0	18.4	20.2
Minimum	442	135	45	55.2	52.0	5.8	13.2	36.5	32.8	15.2	21.7	29.6	17.3	18.4

Note: Measurements are in millimeters; ratios are to condylobasal length; all specimens are males.

Comparison.—*Spilogale phenax phenax* Merriam and *S. p. microrhina* do not differ appreciably from one another in color. The tail of the latter is actually the longer, but in all other parts measured *microrhina* is smaller than *phenax*. Relative to the condylobasal length *microrhina* has the openings of the external nares, the rostrum, and the zygomatic breadth narrower, the mastoid breadth wider, the palatal length, the palatilar length, the occipito-nasal length and the basilar length (of Hensel) shorter, and the tooth row and the postpalatal length longer than has *phenax*. In *phenax* the palate opens relatively farther behind

the last molars than in *microrhina*. In *microrhina* the anterior border of M^1 is generally directed straight inward, thus describing an angle of 90 degrees with the sagittal plane of the skull whereas in *phenax* the anterior border of M^1 is directed inward and backward, thus describing, anteriorly, an angle of less than 90 degrees with the sagittal plane of the skull. The mastoid bullae are more inflated in *microrhina* than in *phenax*.

Spilogale arizonae martirensis Elliot, to judge from the measurements, descriptions and figures given by Howell (*loc. cit.*, pp. 30, 31, 36, pl. 8, figs. 7–9), differs from the new form in the generally smaller size of all parts of the body, the greater width of the lateral stripes, the relatively narrower rostrum and in several other respects that indicate its closer

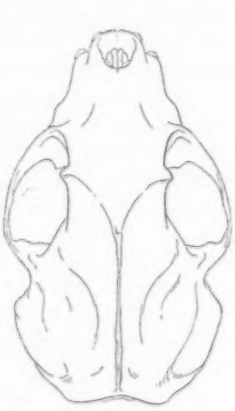

FIG. 1

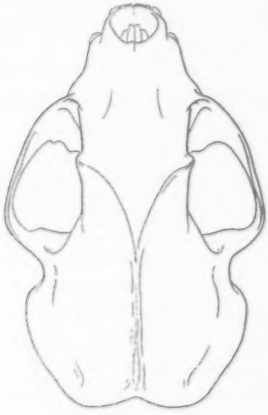

FIG. 2

DORSAL VIEWS OF TWO SKULLS TO SHOW RELATIVE SIZE AND PROPORTIONS IN SPILOGALE PHENAX PHENAX AND S. P. MICRORHINA. NATURAL SIZE

Fig. 1. *Spilogale phenax microrhina*, type, adult male, no. 3215, Mus. Vert. Zool.

Fig. 2. *Spilogale phenax phenax*, topotype, adult male, no. 4278, Mus. Vert. Zool.

Fig. 2 represents an animal whose occipito-nasal length is 1.3 mm. greater than the average of 5 adult male topotypes of *S. p. phenax* (see accompanying table for average). The slightly more than average size of no. 4278 exaggerates the difference in size between the two forms accordingly. Note especially, in addition to the smaller size of *microrhina*, its inflated auditory capsules and small opening of the external nares.

relationship to *arizonae* than to *phenax*. In several respects, however, *microrhina* approaches nearer to *martirensis* than does *S. p. phenax;* but in the absence of actual specimens it is not clear whether this is due to genetic relationship or to the general decrease in size that occurs from north to south within the western American forms.

Several of the characters in which *microrhina* differs from *phenax* are ones in which *microrhina* approaches *Spilogale microdon* Howell. Both *microdon* and *microrhina* have shorter bodies, shorter hind feet, longer tails and smaller skulls than *phenax*. The difference between the mastoid and zygomatic breadth is in *phenax* 4.9 mm.; in *microrhina* 3.2 mm.; in *microdon* (see Howell, *loc. cit.*, p. 37) 1.7 mm. This indicates two things: the relative increase in mastoid breadth and the relative decrease in zygomatic breadth from north to south in the three forms. To judge from Howell's figure of *microdon* (*loc. cit.*, pl. 10, figs. 4–6) the anterior border of M^1 is inclined inward and *forward*. In *microrhina*, as previously stated, it is generally inclined *straight inward*, whereas in *phenax* it is inclined inward and *backward*. The opening of the external nares in *microdon* is apparently reduced fully as much as, if not more than, in *microrhina*. From Howell's description and figures (*loc. cit.*) it appears, however, that *microdon* can readily be distinguished from *microrhina* by the relatively high, narrow braincase, small teeth and broad rostrum.

Specimens from Ventura and Los Angeles counties are slightly nearer *phenax* than are specimens from farther south but are clearly referable to *microrhina*. A single specimen is available from San Luis Obispo County and is clearly intermediate between *phenax* and *microrhina*. No specimens have been examined from Kern, Kings, and Tulare counties where intergradation is likely also to occur.

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AN UNRECOGNIZED WATER SHREW FROM WISCONSIN

By Hartley H. T. Jackson

The water shrews and marsh shrews have in recent years been placed in the genus *Neosorex*, the water shrews in the subgenus *Neosorex* and the marsh shrews in the subgenus *Atophyrax*. A detailed study of all available material of these two groups for the United States Biological Survey makes it necessary to include both in the genus *Sorex*, the water shrews in the subgenus *Neosorex* and the marsh shrews in the subgenus *Atophyrax*. Reasons for this treatment can not be discussed in this brief paper, but will be given in more detail in my monograph of the American long-tailed shrews.

This study has also revealed the necessity for naming a new form of the water shrew from Minnesota, Wisconsin, and northern Michigan. It may be identified by the following description:

Sorex palustris hydrobadistes subsp. nov.

Type-specimen.—No. 229,061, U. S. National Museum, Biological Survey collection; adult ♂, skin and skull; collected July 23, 1918, by Hartley H. T. Jackson. Original number 1211.

Type-locality.—Withee, Clark County, Wisconsin.

Diagnostic characters.—Size slightly smaller than *Sorex palustris palustris;* color in winter pelage, particularly of underparts, pale, about as in *palustris;* color in summer pelage, particularly of underparts, dark, about as in *Sorex palustris albibarbis*. Skull intermediate between that of *palustris* and *albibarbis;* flatter, and with relatively and actually shorter rostrum than in *palustris*.

Measurements.—Type-specimen (adult ♂): Total length, 150; tail vertebrae, 63; hind foot, 20. *Skull* of type-specimen: Condylobasal length, 20.5; palatal length, 8.2; breadth of cranium, 10.2; interorbital breadth, 4.3; maxillary breadth, 6.1; maxillary tooth row, 7.4.

Remarks.—This form represents a peculiar intermediate between *Sorex palustris palustris* and *Sorex palustris albibarbis*. Its skull is essentially intermediate in all characters between *palustris* and *albibarbis*, but in color it is similar to *palustris* in winter and to *albibarbis* in summer. It intergrades with *palustris* in extreme northern Minnesota, and probably with *albibarbis* in Ontario.

The forms of water shrews and marsh shrews as now recognized should be known as follows:

Sorex palustris palustris Richardson
Sorex palustris gloveralleni[1] nom. nov.

[1] The name *Sorex palustris gloveralleni* is here substituted for *Neosorex palustris acadicus* G. M. Allen, which becomes preoccupied by *Sorex acadicus* Gilpin a synonym of *Sorex cinereus cinereus* Kerr.

Sorex palustris albibarbis (Cope)
Sorex palustris hydrobadistes Jackson
Sorex palustris navigator (Baird)
Sorex alaskanus Merriam
Sorex bendirii bendirii (Merriam)
Sorex bendirii palmeri Merriam
Sorex bendirii albiventer Merriam

United States Biological Survey, Washington, D. C.

GENERAL NOTES

NOTES ON THE FEEDING HABITS OF NOCTILIO

The Fish Commission Steamer *Albatross* was used by the Hydrographic Office in the winter of 1883–1884 to make soundings in the Caribbean Sea. I was on board as resident naturalist, with instructions to make any collections possible under the circumstances. A special effort was to be made to get one or more specimens of the cave bird known as *Steatornis caripensis*, commonly called "fat bird," or "guacharo bird," Professor Baird remarking that the National Museum had "not one feather" of this interesting bird. A cave inhabited by these birds was situated on Mona Island. The *Albatross* went January 30 to Port of Spain, Trinidad, and remained until February 2 in that vicinity. Captain Tanner in the meantime obtained a letter of introduction to Mr. Morrison, a Scotsman resident on Mona Island, and taking the dingey in tow by his launch, we went to the little harbor on the island where Mr. Morrison's house was situated. Mr. Morrison promised to take us to the cave in the afternoon and leaving Mr. Willard Nye of New Bedford, a volunteer collector with me, the Captain went back to the ship.

In the afternoon we set out for the sea cave in a canoe, Mr. Morrison and a native paddling. In one place the water was very smooth under the shelter of the land, and a rather large number of pelicans were flying back and forth, or sometimes resting on the surface. Now and then a pelican would plunge into the water, no doubt aiming at the schools of small fish near the surface. In doing this, they wounded some of the fish so that they floated to the surface dead or dying. We saw a number of them as we went on our way. Many rather large bats were flying about with the pelicans, occasionally gliding down to the surface, touching the water it seemed to me with the membrane between the legs and tail, and then ascending with a sharp turn as they touched the water. It appeared to me that they were fishing and had a community interest with the pelicans as it were, taking the crumbs which fell from their table in the form of dead or wounded fish. I did not actually see them take a fish, but they acted as if they were doing so. If not, why were they flying with the pelicans in a bright afternoon? We could not get near enough to shoot one, and Mr. Morrison said that we could paddle to where they lived behind a rock. We soon came to a place where the ocean ground-swell broke against a cliff. Here a huge scale rested against the face of the cliff, the opening being parallel with it. Now and then a bat would go in or out. We put the canoe as close up as was safe, and fired a charge of shot at such an angle that

the shot would rebound into the cleft. Out came the bats, and we shot several as they flew about. An examination of the stomachs revealed the remains of fish exclusively.

The specimens were identified as *Noctilio leporinus* by Mr. Gerrit S. Miller, Jr., when he became Curator of Mammals at the U. S. National Museum, where the specimens are still preserved (U. S. N. M. Nos. 14755 and 14756).—J. E. Benedict, *U. S. National Museum, Washington, D. C.*

INDIAN RECORDS OF CALIFORNIA CARNIVORES

In an earlier issue of this Journal (Vol. 1, 1919–1920, pp. 38–40) C. Hart Merriam records the fact that the Diegueño Indians of southern California were familiar with the jaguar (*Felis onca*). Similar information was given the present writer by northern neighbors of the Diegueño, the Cahuilla Indians of the Coachella Valley and San Jacinto and Santo Rosa Mountains; which in the light of the scant data extant seems worth putting on record. Francisco Nombre, an old clan chief of the Desert Cahuilla near Coachella, stated that in his youth an animal called tu'kwut, described as a large cat with a yellow brown skin marked with spots and having a long tail, was well known in the mountains bordering the desert. He said that the male's tracks were larger than the female's, while the latter track was the same size as that of tu'kwit, the mountain lion. This assumed sex difference may have been pure rationalization, but he was firm in his belief that most of the tracks attributed to the jaguar were very large. The old people made a practice of following jaguar and mountain lion trails in order to uncover and eat the deer remains the animals buried. Jaguar skins as described above, were quite often brought as gifts by mountain Indians to their fathers' "fiestas" on the desert. The last animal of this species he remembers, was killed back of Palm Springs about 1860, by an Indian stalking deer with a deer head disguise. The jaguar attacked the man and was killed by a musket ball. Francisco saw the fresh spotted hide and the long curved claws which were used as a dog collar. Aside from this case, perhaps one of mistaken identity on the part of the jaguar, no case of a jaguar or a mountain lion attacking anyone was secured. As the informant in question had never heard the term jaguar, nor of the more familiar "el tigre" of the Mexicans, it is highly improbable that he invented the foregoing data. The Mountain Cahuilla use the term tu'kwut in a vague way for any strange animal, for example a lion or a tiger in a circus, but no informant questioned knew the exact derivation of the term. One old man, Cornelio Lubo, said, however, that he believed it meant a cat larger than a mountain lion, but he had never seen one.

Another term in the Cahuilla language that has a doubtful zoölogical derivation is the word iswit, which is used at present as a synonym for tu'kwit or mountain lion. The older Cahuillas say that it means wolf, but no informant questioned had ever seen this animal in the flesh. The Spanish equivalent for iswit is lobo, a corruption of which, lubo, is now employed as a clan and family name in the San Jacinto Mountains. Dr. Joseph Grinnell tells me that so far as he knows no wolf has ever been taken west of the valley of the Colorado River or south of the Tehachapi. Either the term iswit was employed by the ancestors of the present Indians in a previously occupied territory, acquired through contact with other tribes, or else the former range of the wolf extended

into the San Jacinto and Santa Rosa Mountains. One of the former explanations seems most reasonable.

The California grizzly bear (*Ursus magister* Merriam), called hu'nwit by the Cahuilla, was regarded as a very dangerous animal by all the southern California Indians, and when a man-killing individual came into the neighborhood the clans affected grouped together and either drove him out of the neighborhood or killed him. The former course was considered the more desirable, but whenever possible the bear was unmolested. A case where a grizzly killed two Indian women on Cahuilla peak about fifty years ago, led to its being hunted down and killed near Palm Springs. The last bear of this species remembered by Alejo Potencio was killed by white men back of Indian Wells about thirty years ago.—WILLIAM DUNCAN STRONG, *University of California, Berkeley, California.*

SQUIRRELS MIGRATE FROM WISCONSIN TO IOWA

The following press item from Prairie du Chien, Wisconsin, for October 16, 1925, reports an interesting and unusual migration of squirrels:

"An acute shortage in the Wisconsin nut crop is causing thousands of squirrels [*Sciurus carolinensis leucotis*] to seek the more bountiful corn fields of Iowa, according to hunters and fishermen who come to this city daily with stories of witnessing hundreds of the bushy-tailed animals gamely swimming across the Mississippi River.

"Entire armies of the animals congregate on the Wisconsin side and wait for calm weather before attempting the long swim. Rough weather has proved fatal to many, whose bodies have been washed up on both shores, the hunters report."

The writer has not had opportunity to verify these interesting reports.—F. M. FRYXELL, *Augustana College, Rock Island, Illinois.*

A NEW GROUND SQUIRREL FOR COLORADO

While engaged in some work on the Zuni prairie dog in Montezuma County, Colorado, for the State Entomologist, Colorado Agricultural College, during the summer of 1925, I trapped two specimens of *Citellus spilosoma cryptospilotus* (Merriam) on July 27 and 29. The specimens were identified by Mr. Arthur H. Howell, of the U. S. Biological Survey. These squirrels, a male and female, occupied burrows in the sage-covered sandy slopes of McElmo Creek, south of Cortez, Township 35 S., Range 16 W., Section 35.

The burrow at which the first specimen was caught was excavated. It proved to be a deserted prairie-dog burrow. The soil at this particular place was sandy, underlaid with a soft chalky limestone. The field showed limestone rock formation over approximately a third of the surface. A few *Juniperus monosperma* were scattered over this field. Excavation of the burrow at which the second catch was made showed that it resembled burrows of other ground squirrels.

As this location is in the Upper Sonoran Zone, the habitat is not unlike that of this species in New Mexico. The range of the subspecies in southwestern Colorado is not known. However, the squirrels must be rare, as only the two specimens taken were seen during the season's work.

The stomach of one specimen contained numerous small Dipterous larvae. The specimens are in the Museum of the Colorado Agricultural College.—SAM C. MCCAMPBELL, *Colorado Agricultural College, Fort Collins, Colorado.*

A PORCUPINE THROWS QUILLS

When I mention a porcupine throwing his quills it will no doubt be thought that I am returning to the Dark Ages of science, yet it is of this subject that I write. While hunting with a camera in the woods of Nova Scotia during the summer of 1923, I saw a porcupine, not "shoot," but throw his quills at least five feet and strike a man. We found this porcupine in a tree which we cut down and my guides with the aid of long forked sticks began driving him toward an open place where I should have light enough to photograph him. Suddenly he took a notion to charge down a little path in a direction we did not wish him to go. One of the guides jumped in front of him and held out a stick at arms length to stop him. The porcupine flicked his tail and sent two quills into the guide's shoulder.

Mr. C. Emerson Brown, superintendent of the Philadelphia Zoölogical Gardens, has explained the whole thing to my utmost satisfaction by saying that the quills in the porcupine's tail were loose and struck the guide merely by accident. He says that the porcupine had not the power to voluntarily throw or aim them.

Nonetheless, if quills as loose as these are common in the tails of porcupines, the animals would not need to be proficient in aiming to make it dangerous to go very near them. However, the incident that I witnessed is the only authentic one of its kind of which I know, and I would be very much obliged to any one who could furnish me with further information.—ALEXANDER H. LEIGHTON, *Rosemont, Pennsylvania.*

TWO MUSK-OX CALVES BORN IN NEW YORK

The possibilities in colonizing musk-ox herds in northern Canada and Alaska are now seriously engaging the attention of both the Canadian and United States governments. Until very recently no musk-ox calves ever have been born in captivity in North America, and if any births ever occurred in Europe, the records of them are so obscure as to be unknown on this side of the world.

Quite recently a letter appeared in a New York newspaper attacking the director of the New York Zoölogical Park for his alleged mismanagement of the Park's herd of five musk-ox, now two and one-half years old. Corsan said: "In their present quarters they never will breed, and are sure to die long before their time."

Six days later, September 7, 1925, the musk-ox herd presented the Park with a calf—the first ever born in captivity in America, and on September 14 another came. The first one was eighteen inches high at the shoulders and weighed sixteen pounds. While both calves were perfect and healthy animals at birth, they lacked vigor, and their two young mothers had practically no milk. A nursing bottle, cow's milk, and finally a milch goat were tried, but while calf No. 2 did its best to make good, the immaturity of the two young mothers was too great a handicap on the offspring. Each calf survived only four days.

The Park herd is in the pink of condition, it has never suffered any from the summer heat of New York, and it is reasonably certain that later on other calves will be born and successfully reared.—W. T. HORNADAY, *New York Zoölogical Society, New York, N. Y.*

LLOYD'S DEGREASING APPARATUS

In the August (1925) number of this JOURNAL, Mr. Harley B. Sherman figures and describes an apparatus for removing the grease from mammal skins and osteological material. Mr. Sherman is apparently unaware of an article in THE AUK, 1918, pp. 164–169, by Mr. Hoyes Lloyd, an experienced analytical chemist, on the extraction of fat from bird skins. Mr. Lloyd figures an apparatus differing in no practical way from that figured by Mr. Sherman seven years later, and describes the effect of the solvent ethyl ether on bird skins. This solvent he preferred, but remarks, "The use of such other solvents as petroleum ether, gasoline, and carbon tetrachloride for extracting fat can be experimented with to advantage, using this apparatus."

The Victoria Memorial Museum at Ottawa constructed a degreasing apparatus soon after Mr. Lloyd's experiments were concluded, and on his advice carbon tetrachloride was used with excellent results. My interest in Mr. Lloyd's experiments in degreasing bird skins was based upon the necessity of arresting decay in historically valuable skins rather than in removing fat from fresh material. Skins which were past saving by any other process were treated by him in 1918, and are today, as far as it is possible to judge, chemically free from fat, and consequently safe from further decay. Other museums have, I believe, constructed and used apparatus based on Mr. Lloyd's experiments. I saw one in the Field Museum, Chicago, in 1922, but as far as I know Mr. Sherman is the first to suggest its use in degreasing mammal skins.—J. H. FLEMING, *Toronto, Ontario.*

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COMMENT AND NEWS

The annual meeting of the American Society of Mammalogists will convene in New York City, April 28 to May 1, 1926. The first three days will be devoted to papers and business, with an excursion of mammalogical interest on the fourth day. Headquarters will be at Sherman Square Hotel. The committee on arrangements is H. F. Osborn, chairman; H. E. Anthony; H. Lang; W. K. Gregory; and Childs Frick.

The James Simpson-Roosevelt Asiatic Expedition of the Field Museum, conducted by Theodore and Kermit Roosevelt, has concluded its program with a successful hunt for tigers, rhinos, and other large game in northern India. It will be recalled that this party left America in April for Bombay. During the summer and autumn of 1925, the expedition crossed the Himalayas to Turkestan and continued northward to the Thian Shan Mountains where it obtained sheep, ibex, bear, and other mammals. Two heads of record size were included, one of the Thian Shan ibex (59½ in.) and one of the Thian Shan sheep (61 in.). Later, a rapid trip was made into the Russian Pamirs where eight specimens of Marco Polo's sheep were taken, including four large rams. Mr. George K. Cherrie, naturalist of the expedition, reports a collection of some 800 small mammals and birds and a number of reptiles and amphibians.

Hereafter members must notify the corresponding secretary within two months of date of issue in order to secure copies of the JOURNAL that have gone astray in the mails, or to secure substitution for an imperfect copy.

It is expected that Edmund Heller of the Field Museum will return to the United States early in 1926 after more than two years' field work in central Africa. He reports having obtained several thousand mammals, mainly in the Belgian Congo, including an especially fine collection of some 800 specimens from Mount Ruwenzori. Among the large mammals are fine male okapi from the Ituri forest, two gorillas from the Congo forest, and one from western Uganda. When last heard from, Mr. Heller, with Mrs. Heller who accompanies him, was about to start on a difficult trip into the Congo forest west of Lake Kivu for the purpose of securing a group of gorillas.

Mr. H. E. Anthony has been promoted to the position of Curator of Mammals in the American Museum of Natural History, New York.

The University of Pittsburgh has recognized the possibilities of nature study through the use of motion pictures. Norman McClintock, a graduate of Yale University, has been appointed photo-naturalist with the rank of professor on the zoology staff of that institution, and took up his duties at the beginning of the college year 1925–1926. All of Mr. McClintock's films, the result of his fifteen years of effort, will be used by the University. Only a small appropriation is available for the project at present, but it is expected that it will be increased as the work expands.